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of the
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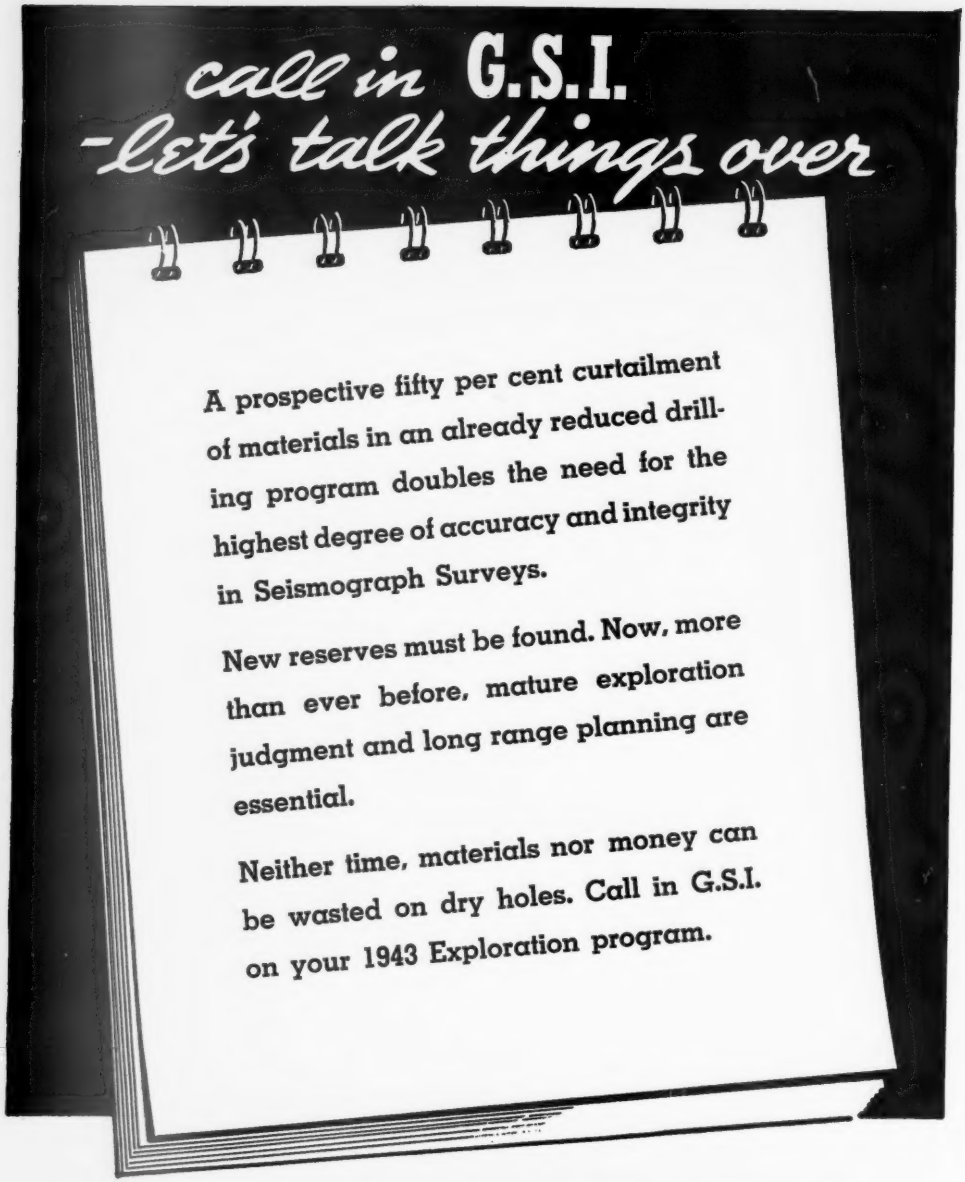
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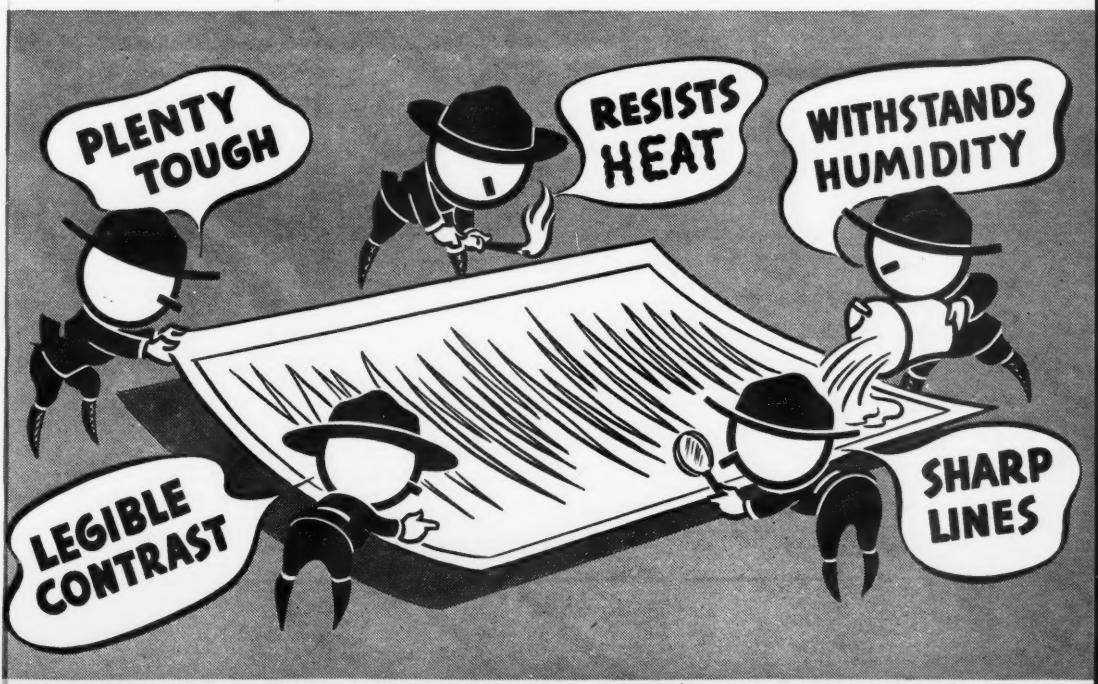
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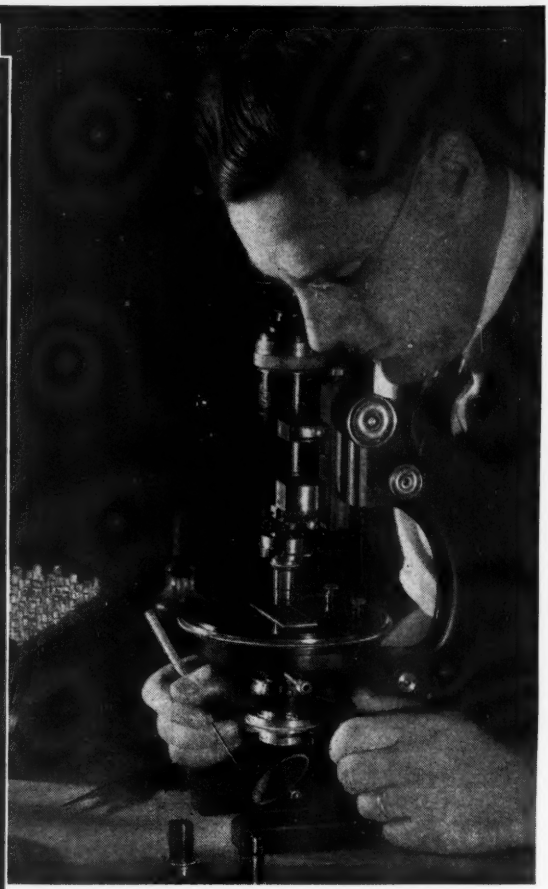
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By PHILIP B. KING

Geologist, Geological Survey, United States Department of the Interior
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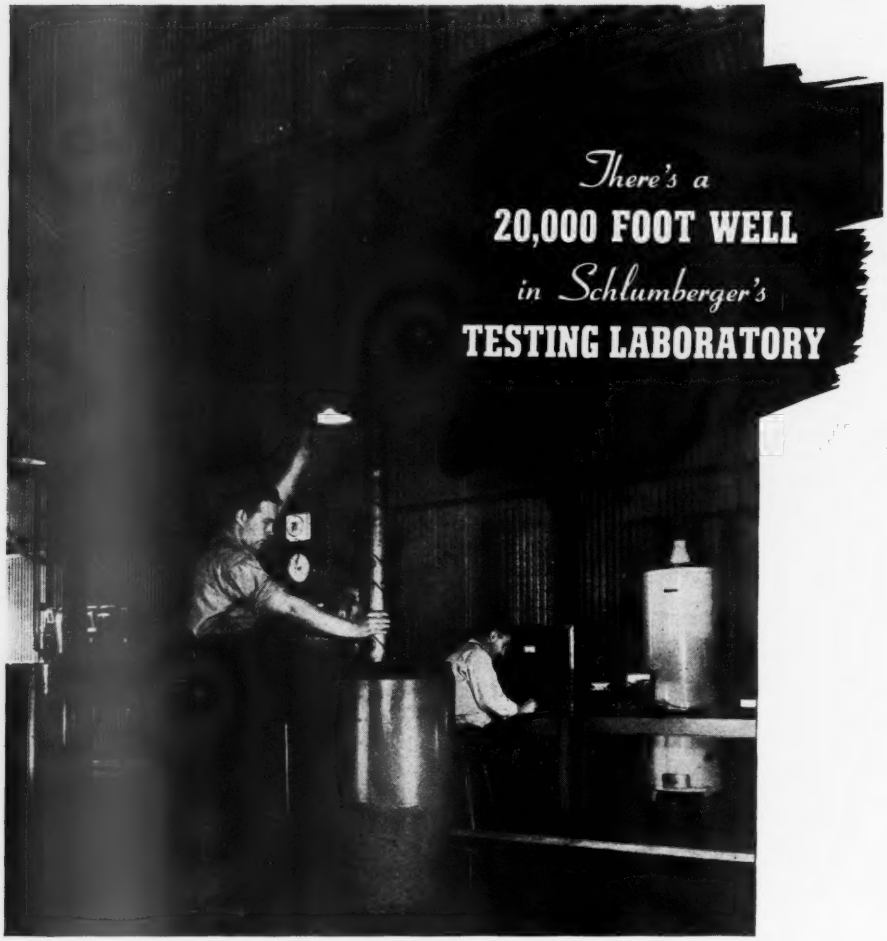
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JUNE, 1943

WILDCAT DRILLING IN 1942[1]

FREDERIC H. LAHEE[2]
Dallas, Texas

ABSTRACT

The total number of wildcats drilled in 1942, in the states covered by this report, was 3,212, and the footage drilled was 12,123,994, as contrasted with 3,264 holes and 11,615,085 feet, respectively, in 1941. The average depth of hole increased from 3,559 feet to 3,775 feet for all states covered, and from 4,372 feet to 4,647 feet in the southern states.

This résumé on wildcatting is followed by a study of discovery rate in the eleven states of Arkansas, California, Illinois, Indiana, Kansas, Louisiana, Michigan, Mississippi, New Mexico, Oklahoma, and Texas. Discovery rate is measured by the relations between wildcatting and the discovery of new reserves during the last 6 years. Except for a slight rise, in 1941, in the curves expressing rate of discovery, there has been a decline since 1937. Last year, in our annual résumé, we stated that these facts are a challenge to the industry not only to expand exploration, but also to promote research which may in any manner improve or revise our present methods of looking for oil. This same challenge remains to-day, and the urgency for improvement in the situation is greater than ever. Many more wildcats must be drilled, but to do this we should have sufficient materials and manpower, sufficient practical incentive, and protection from burdens too severe, both financial and legal.

This paper reviews data on wildcat drilling for the eighth consecutive year.[3] The states from which information was available are indicated in Figure 1.

We have continued to use the definition of a wildcat as a hole drilled completely outside the known boundaries of pools already developed, and far enough from producing areas to be essentially a test of new possibilities. Generally speaking, such a hole would be at least 2 or 3 miles from production; but, where subsurface conditions may change within short distances, as in the case of lensing sands and salt-dome structures, and where, consequently, predictions based on the known may turn out to be greatly in error, a test hole may be regarded as a

[1] Read before the Association at Fort Worth, April 8, 1943. Manuscript received, March 22, 1943.

[2] Chief geologist, Sun Oil Company.

The writer acknowledges with thanks the kind assistance and coöperation of the following gentlemen in compiling data for this summary: A. P. Allison, A. H. Bell, A. S. Berger, K. E. Born, N. Burnett, D. H. Cardwell, George V. Cohee, R. J. Cullen, M. H. Funk, G. C. Gester, M. D. Hubley, E. A. Koester, C. S. Lavington, G. D. Lindberg, A. M. Lloyd, Graham B. Moody, D. J. Munroe, Jack Parker, C. H. Row, G. C. Sleight, L. C. Smith, and E. B. Wilson.

[3] See this *Bulletin*, Vol. 21, pp. 1079–82; Vol. 22, pp. 645–48, 1231–35, 1236; Vol. 23, pp. 789–94; Vol. 24, pp. 953–58; Vol. 25, pp. 997–1003, 1938, 1939; and Vol. 26, pp. 969–82.

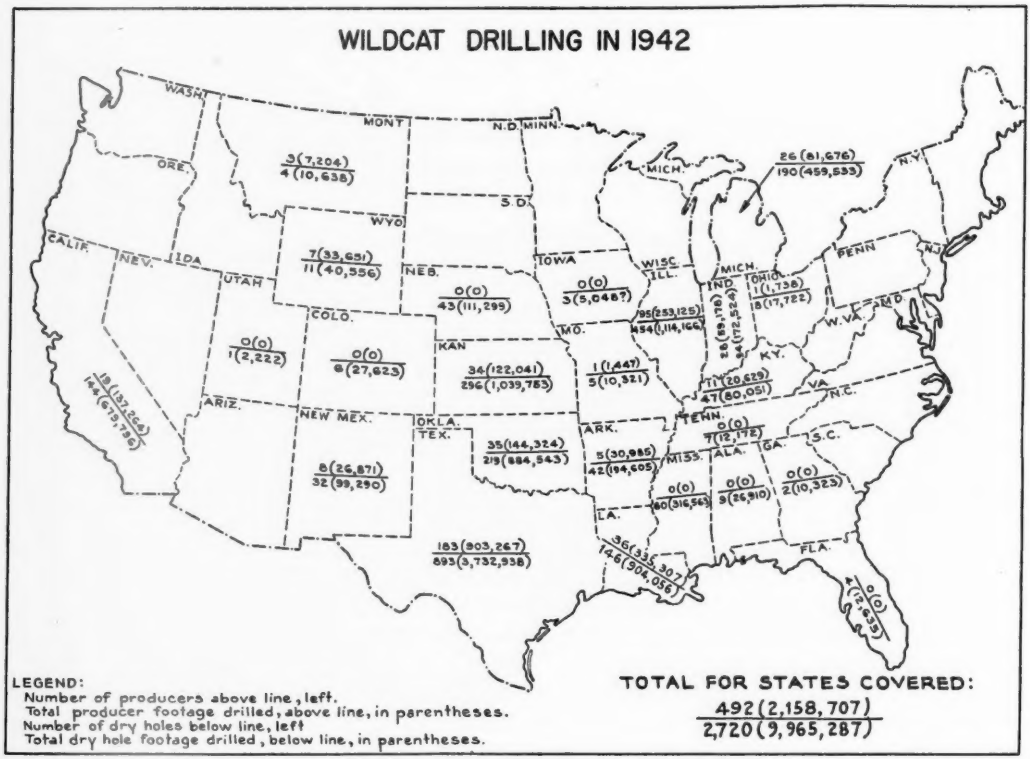

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3(7,204)
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7(33,651)
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8(26,871)
32(99,290)
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219(884,543)
183(903,267)
893(3,732,938)
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5(10,321)
95(253,125)
454(1,114,166)
5(30,985)
42(194,605)
0(0)
60(316,543)
36(135,307)
146(904,056)
26(81,676)
190(459,533)
1(1,736)
18(17,722)
28(89,778)
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2(10,323)
1(0)
4(24,835)
LEGEND:
Number of producers above line, left.
Total producer footage drilled, above line, in parentheses.
Number of dry holes below line, left
Total dry hole footage drilled, below line, in parentheses.
TOTAL FOR STATES COVERED:
492(2,158,707)
2,720(9,965,287)

FIG. 1

wildcat even if it is only $\frac{1}{2}$ or $\frac{3}{4}$ mile from production or from an abandoned dry hole. It is important to note that this does not make *distance* from a pool the sole factor in the definition. Often a hole to be drilled within less than a mile from production is just as much a wildcat, is just as much a financial risk, and should receive just as much encouragement in the search for new reserves, as a hole two or three miles from production. In every case the degree of uncertainty of the geological conditions should be taken into consideration.

In compiling the data, questions have arisen as to just how to classify footage drilled in certain wells which are strictly neither dry holes nor producers from top to bottom. For instance, within the boundaries of a pool a hole may be drilled below the lowest pay zone in search of some unknown new "pay." In the sense that it is exploring for deeper untested possibilities, its footage drilled below the lowest known "pay" is wildcat. It might be called a semi-wildcat. If it discovered oil or gas in a deeper formation this extra footage might be listed as semi-wildcat discovery footage; and if, on the other hand, it failed to find a deeper "pay," the depth drilled below the lowest producing formation would then be termed semi-wildcat dry footage. Semi-wildcat footage of this kind amounts to only a very small percentage of the total wildcat footage, and a hole deepened for the purpose of seeking new unknown "pays" below the deepest known producing formation is hardly to be regarded or listed as a wildcat hole, provided it was drilled originally with the object of producing from the known formation. However, a hole which is drilled within the limits of a pool, but with the express object, from the start, of passing up the known "pays" and going on down to look for new prospects is, we believe, properly listed as a wildcat and is credited with its entire footage from the surface of the ground.

A somewhat similar case is that of a wildcat well drilled through one or more prospective pay zones to a considerably greater depth and then plugged back to completion as a producer. In a hole of this kind, since the total depth would be charged against the cost of the completed producer, we have listed this well and its *total* depth in the column for producers.

A question was raised last year as to whether actual footage drilled within the calendar year should be the basis of "footage drilled" or whether, as in past reports, the total footage of all the holes actually completed or abandoned within the calendar year should be used. We have continued the latter course, first, in order that this year's figures may be more properly comparable with the figures in the earlier reports; second, because the former method requires more detailed analysis on the part of those furnishing the statistics; and third, because we are as much concerned with individual holes, as with footage in these holes, and the former method would involve considerable repetition in the *number* of holes wherever the holes were started in one year and finished in a succeeding year.

On the maps (Figs. 1, 2, and 3), numbers in parentheses indicate total footage drilled; figures preceding parentheses indicate the number of holes drilled; figures


SE. NEW MEXICO
7 (19,921)
30 (97,526)
OKLAHOMA
1 (3,256)
7 (47,249)
43 (187,008)
153 (459,022)
26 (130,864)
70 (319,760)
30 (84,635)
112 (273,719)
2 (6,103)
55 (220,605)
5 (7,627)
30 (108,119)
8 (50,935)
50 (228,601)
23 (98,226)
80 (542,305)
4 (15,895)
63 (189,902)
20 (105,055)
91 (519,438)
21 (103,665)
182 (824,218)
TOTAL TEXAS
183 (903,267)
893 (3,732,938)
① = TEXAS RAILROAD COMMISSION DISTRICTS.
TEXAS
ARKANSAS
5 (30,985)
42 (194,605)
LOUISIANA
36 (335,307)
146 (904,056)
MISSISSIPPI
0 (0)
60 (316,563)
ALABAMA
0 (0)
9 (26,910)
GEORGIA
0 (0)
2 (10,323)
SOUTH CAROLINA
FLORIDA
4 (12,635)
TOTAL
231 (1,289,480)
1,186 (5,295,556)
ONE PRODUCER FOOT
FOR EVERY
4.11 FEET DRY
WILDCATS, 1942

FIG. 2


SE NEW MEXICO
6 (13,996)
35 (89,462)
OKLAHOMA
0 (0)
3 (13,258)
69 (262,054)
135 (475,634)
24 (104,728)
61 (274,686)
34 (96,833)
113 (302,536)
1 (8,474)
58 (207,540)
4 (16,332)
75 (351,143)
7 (27,890)
18 (33,647)
19 (163,483)
114 (794,334)
7 (28,267)
103 (253,772)
15 (79,577)
103 (483,490)
34 (151,283)
213 (860,375)
TOTAL TEXAS
214 (938,921)
996 (4,030,415)
① = TEXAS RAILROAD COMMISSION DISTRICTS
TEXAS
ARKANSAS
5 (39,648)
35 (111,525)
LOUISIANA
31 (263,029)
171 (1,080,312)
MISSISSIPPI
2 (9,180)
50 (241,793)
ALABAMA
0 (0)
14 (20,816)
GEORGIA
0 (0)
1 (1,935)
SOUTH CAROLINA
0 (0)
2 (2,117)
FLORIDA
0 (0)
1 (600)
TOTAL
258 (1,264,774)
1,305 (5,578,975)
ONE PRODUCER FOOT
FOR EVERY
4.41 FEET DRY
WILDCATS, 1941

FIG. 3

above the cross line are for producing wells, that is, oil, oil and gas, distillate and gas, and gas; and figures below the cross line are for dry holes.

In the states covered in this review, as shown in Figure 1, and listed in Table I, during 1942 a total of 12,123,994 feet was drilled in 3,212 holes, divided as follows.

	Feet
492 producers	2,158,707
2,720 dry holes	9,965,287

This means that 15.3 per cent of the holes drilled, and 17.8 per cent of the footage drilled, was successful in 1942. One producer foot was drilled for every 4.62 feet of dry hole. One discovery well was drilled for every 5.52 dry holes. The average depth of hole was 3,775 feet.

In the southern states district (Fig. 2), in 1942, a total of 6,585,036 feet was drilled in 1,417 holes, divided as follows.

	Feet
231 producers	1,289,480
1,186 dry holes	5,295,556

In this area, then, 16.3 per cent of the holes drilled, and 19.6 per cent of the footage drilled, was successful. One producer foot was drilled for every 4.11 feet of dry hole. One discovery well was drilled for every 5.1 dry holes.[4] The average depth of hole was 4,647 feet. For comparison with statistics for this same area in 1938, 1939, 1940, and 1941, see Table II.

Selection of the location for a wildcat well may be based on geology (surface geology, subsurface geology, trend along known structural or stratigraphic conditions, local or regional, or shallow exploratory drilling); or it may be based on geophysics (exploration by seismograph, torsion balance, gravity meter, magnetometer, *et cetera*); or it may be based on some non-technical suggestion or requirement, such as "creekology," "hunch," "doodlebug," promotion, lease obligation, reported showing of oil or gas in holes previously drilled, *et cetera*. In many cases the reason for choosing the location can not be ascertained.

The reader will observe that this year, in Figure 2, we are dividing Texas into the several Railroad Commission districts instead of the larger scout districts previously used. This may have several advantages. In order to facilitate comparison with 1941 figures, we are introducing Figure 3 in which the Texas statistics for 1941 are likewise shown by the Railroad Commission districts.

In Table III are listed the reasons for drilling the wildcats in 1942 using the best information available from men familiar with such statistics, each in his own state or district. According to these figures, 459 wildcats drilled on technical

[4] It may be of interest to note that statistics, based on wildcat drilling in 1939–1941, have shown that about as much steel is consumed (surface and other strings of pipe set in hole, *et cetera*) in five abandoned dry wildcats as in one completed producer wildcat (casing strings, Christmas tree, surface connections). In other words, in the southern states area, experience indicates that six wildcats of average depth, out of which one, on the average, may be expected to produce, will consume, or remove from the possibility of subsequent use, about as much steel as two average producer wildcats.

TABLE I

Number of Oil Wells, Gas Wells, and Dry Holes Drilled as Wildcats in 1942

States	Oil Discovery		Gas Discovery*		Dry		Total Number of Holes	Total Footage Drilled	Average Depth of Hole in Feet**
	Number of Holes	Footage Drilled	Number of Holes	Footage Drilled	Number of Holes	Footage Drilled			
Alabama	0	0	0	0	9	26,910	9	26,910	
Arkansas	3	20,454	2	10,531	42	194,605	47	225,590	4,800
California	18	132,010	1	5,254	144	679,796	163	817,060	5,013
Colorado	0	0	0	0	6	27,623	6	27,623	
Florida	0	0	0	0	4	12,635	4	12,635	
Georgia	0	0	0	0	2	10,323	2	10,323	
Illinois	89	249,887	6	3,238	454	1,114,166	549	1,367,291	2,490
Indiana	28	59,178	0	0	94	172,524	122	231,702	1,899
Iowa	0	0	0	0	3	5,048?	3	5,048?	
Kansas	30	107,433	4	14,608	296	1,039,753	330	1,161,794	3,521
West Kentucky	10	19,364	1	1,265	47	80,051	58	100,680	1,736
Louisiana	22	195,850	14	139,457	146	904,056	182	1,239,363	6,809
Michigan	23	75,936	3	5,740	190	459,533	216	541,209	2,506
Mississippi	0	0	0	0	60	316,563	60	316,563	5,276
Missouri	1	1,447	0	0	5	10,321	6	11,768	
Montana	2	5,652	1	1,552	4	10,638	7	17,842	
Nebraska	0	0	0	0	43	111,299	43	111,299	2,588
New Mexico	7	19,921	1	6,950	32	99,290	40	126,161	3,154
Ohio, Northwest	1	1,738	0	0	8	17,722	9	19,460	
Oklahoma	32	137,542	3	6,782	219	884,543	254	1,028,867	4,051
Tennessee	0	0	0	0	7	12,172	7	12,172	
Texas	140	657,823	43	245,444	893	3,732,938	1,076	4,636,205	4,309
Utah	0	0	0	0	1	2,222	1	2,222	
Wyoming	4	20,313	3	13,338	11	40,556	18	74,207	
Totals	410	1,704,548	82	454,159	2,720	9,965,287	3,212	12,123,994	3,775

* Gas-and-distillate wells, of which there were 29, are included in this column.
** Averages have been recorded here only for states where more than 25 wildcats were drilled in 1942.

TABLE II

Comparative Statistics for All States Shown in Figure 2*

	Producers Drilled				Dry Holes Drilled				Total Number Wildcats Drilled	Total Feet Drilled	Average Depth of Hole (Feet)	Number of Dry-Hole Feet Drilled for Each Producer Foot
	Holes		Footage		Holes		Footage					
	Number	Per Cent	Feet	Per Cent	Number	Per Cent	Feet	Per Cent				
1938	200	13.6	984,262	17.4	1,271	86.4	4,667,402	82.6	1,471	5,651,664	3,842	4.74
1939	161	12.6	779,345	14.8	1,113	87.4	4,501,669	85.2	1,274	5,281,014	4,145	5.90
1940	187	12.8	919,506	14.9**	1,279	87.2	5,251,273**	85.1**	1,466	6,170,779	4,209**	5.71**
1941	258	16.5	1,264,774	18.4	1,305	83.5	5,578,975	81.6	1,563	6,843,749	4,372	4.41
1942	231	16.3	1,289,480	19.6	1,186	83.7	5,295,556	80.4	1,417	6,585,036	4,647	4.11

* In this table New Mexico data are from the southeastern part of the state only.
** See *Bull. Amer. Assoc. Petrol. Geol.*, Vol. 25, p. 1938, where corrections are mentioned for these figures as they appeared in Table II, p. 1001, of the same volume.

advice (geology and (or) geophysics) were successful (oil or gas), and 2,052 were dry; 22 holes, located for non-technical reasons, were producers, and 587 were dry; 12 producers and 80 dry holes were located for reasons unknown. These figures show that 18.3 per cent of the holes drilled on technical advice were producers as contrasted with 4.9 per cent successful in the case of the holes located without technical advice. Therefore, in 1942 locations based on technical recommendations were more than 3.7 times as successful as those drilled without such advice. In the southern states area (Fig. 2) 2.8 per cent of the wildcats, located without technical advice, were producers, whereas 19.2 per cent of the holes located on technical advice were producers.

Comparing last year's figures[5] with figures for 1942, we note the following conspicuous changes.

1. There was an increase in wildcat drilling in California (up from 124 holes in 1941 to 163 holes in 1942, and up from 640,470 feet drilled in wildcats in 1941 to 817,060 feet in 1942); and in Kansas (up from 237 wildcat holes and 828,473 feet drilled in wildcats in 1941 to 330 holes and 1,161,794 feet in 1942). This was a 31 per cent increase in holes and a 27.5 per cent increase in total footage in California, and a 40 per cent increase in both number of holes and total footage in Kansas. In Mississippi 60 wildcats were drilled in 1942 as compared with 52 in 1941, but the footage increased considerably—from 250,933 feet in 1941 to 316,563 feet in 1942. In Oklahoma there was a slight increase in number of wildcats drilled (up from 246 to 254), and the footage increased from 910,969 feet to 1,028,867 feet.

2. On the other hand, there were moderate decreases in Illinois (591 holes, in 1941, down to 549 holes, in 1942, but the footage increased from 1,341,743 in 1941 to 1,367,291 in 1942); in Louisiana (202 holes and 1,343,341 feet drilled, in 1941, down to 182 holes and 1,239,363 feet drilled, in 1942); and Michigan (231 holes drilled in 1941 contrasted with 216 holes in 1942; but the total footage here increased from 515,969 in 1941 to 541,209 in 1942). In Texas there was a larger drop from 1,210 holes and 4,969,336 feet in 1941, to 1,076 holes and 4,636,205 feet in 1942. For Texas this was an 11 per cent drop in wildcats drilled and a drop of 6.7 per cent in wildcat footage drilled in 1942 as contrasted with 1941.

3. Rather striking is the fact that, in 1942, the average depth of hole increased in all these states except California. The largest increases in average depth of hole were in Mississippi and Oklahoma (in each case a 9 per cent increase), and in Texas (an increase of 5 per cent).

4. The degree of success of wildcatting with technical advice on locating the hole is still several times that where no technical advice is used, but there seems to be quite a little variation from year to year. In 1937 there were 3 times as many discovery wildcats drilled on technical advice as there were drilled for non-technical reasons; in 1938 this factor had decreased to between 2.2 and 3.2, and

[5] F. H. Lahee, "Wildcat Drilling in 1941 with Comments on Discovery Rate," *Bull. Amer. Assoc. Petrol. Geol.*, Vol. 26, No. 6 (June, 1942), pp. 969–82.

* In this table New Mexico data are from the southeastern part of the state only.
** See *Bull. Amer. Assoc. Petrol. Geol.*, Vol. 25, p. 1938, where corrections are mentioned for these figures as they appeared in Table II, p. 1001, of the same volume.

TABLE III

BASIS FOR LOCATING WILDCATS DRILLED IN 1942

State	Geology		Geophysics*		Geology and Geophysics		Sundry Non-Technical		Unknown		Totals		Grand Total
	Prod.	Dry	Prod.	Dry	Prod.	Dry	Prod.	Dry	Prod.	Dry	Prod.	Dry	
Alabama		3		3				3				9	9
Arkansas	1	13	4	15		4		8		2	5	42	47
California	14	94	2	11	3	16		21		2	19	144	163
Colorado		3		2				1				6	6
Florida								4				4	4
Georgia				1				1				2	2
Illinois	67	293	5	25	5	13	7	83	11	40	95	454	549
Indiana	23	37	5	13				26		18	28	94	122
Iowa		2						1				3	3
Kansas	23	110	5	56	2	12	4	118			34	296	330
West Kentucky	11	38				2		7			11	47	58
Louisiana	19	37	17	73		9		21		6	36	146	182
Michigan	27	187		2							27	189	216
Mississippi		22		21				17				60	60
Missouri	1	5									1	5	6
Montana	2	2					1	2			3	4	7
Nebraska		9		3		2		29				43	43
New Mexico	6	28		1	2	2		1			8	32	40
Ohio, Northwest		4						3	1	1	1	8	9
Oklahoma	9	71	22	84	1		3	64			35	219	254
Tennessee		4						3				7	7
Texas	101	466	49	173	26	73	7	171		10	183	893	1,076
Utah		1										1	1
Wyoming	3	4	1	2	3	1		3		1	7	11	18
Totals	307	1,433	110	485	42	134	22	587	12	80	493	2,719	3,212

* Including geochemistry.

in 1939 it had further decreased to between 1.5 and 2.2. In 1940, it jumped to 3.7, and in 1941 it increased further to more than 5. In 1942, it was 3.7.

Those who are especially concerned with the results of seismographic work will be interested to know that, in 1942, 108 wildcats out of 559 located on seismographic data were successful, and an additional 52 wildcats were successful out of 163 located on a combination of seismographic and geologic advice.

Wildcatting is the industry's method of seeking new oil. From the experience of 1941 and 1942 we may say that one wildcat in approximately 6.5 is successful —and this takes into consideration not only all oil discovery wells but also those which discover gas or distillate and gas.

There is still an amazing degree of ignorance, or a lack of understanding, evidenced by many people who, in one way or another, are led to use statistics on wildcatting and on oil reserves. And it is notorious that the people who most severely criticize the data and estimates published by committees composed of trained, careful, conservative scientists, are those who do not take the time or trouble to read the reports presented in explanation of these data and estimates. For this reason we shall quote *verbatim* from our report of last year where we attempted to explain the meaning of "proved reserves" and of "discovery rate."

After a successful wildcat has been completed as a producer, other wells are subsequently drilled and these gradually outline the limits of the pool. Where development is slow, or the pool is large, this process of outlining the pool may require several years. There is always a lag. After the first well has been completed, or perhaps after several wells have been completed, an estimate can be made of the quantity of oil present in the drilled area, and this area is taken as essentially proved. If the pay sand is thick and uniform and fairly even in its permeability, a larger acreage may be regarded as "proved" by the drilling than in the case where the sand is thin, irregular in permeability, and likely to pinch out. If the form and dimensions of the structure, or "trap," are pretty definitely known, an early estimate may be attempted of the quantity of oil present in the whole reservoir, including its undrilled parts. This is an attempt to guess at the ultimate total reserve rather than at the "proved" part of this ultimate total reserve.

Both of these methods of estimating reserves[6] are justified. Each has its definite uses, but *the two should not be confused.* Where estimates are made of *proved* reserves, additions and revisions are periodically necessary, and eventually, after a pool has been completely drilled, the original estimate of the proved reserve plus the subsequent additions and revisions may come somewhere near the total ultimate reserve as estimated near the beginning of development of the pool. However, it is evident that such an early estimate, based on scanty data, is likely to be in error, and the percentage error is likely to be much greater than the percentage error in an estimate of *proved* reserves, made at any given time.

Rate of discovery is the rate at which new oil reserves are discovered, but a graphic picture of this rate may vary considerably according to whether we regard as the oil discovered in any given year the quantity of new oil *proved* by drilling in that year, or the quantity of total new oil estimated to fill the reservoir, or reservoirs, discovered in that year. Although in overlapping periods of several years each, the pictures might be somewhat similar, in single-year intervals there may be wide discrepancies between the rate of discovery calculated in the two ways, due to lag in development, size of pool, *et cetera.*

[6] See F. H. Lahee, "This Matter of Estimating Oil Reserves," *Bull. Amer. Assoc. Petrol. Geol.*, Vol. 25 (1941), pp. 164–66.

The suggestion has been offered that a more correct picture of the rate of discovery could be obtained by annually relegating back to the year of discovery the reserves subsequently uncovered each year by drilling; but this would not only involve an enormous amount of work, but also, in the end, as far as we can see it, there would be little gained For of what particular value would it be for us to know, *merely as a means of gauging discovery rate*, that a reserve of over 4 billion barrels of oil was found in 1930 in the East Texas field? Of more significance—again, only as applied to the study of discovery rate—is the quantity of new oil made available each year as drilling of this field progressed. We repeat that, while there *are* real and important reasons for making early estimates of total ultimate reserves in a pool, we believe that *the soundest method of measuring rate of discovery must be based on new reserves as proved by drilling.*

TABLE IV

*Estimated Proved Reserves in U. S. at Beginning of Year** (*Barrels*)		*Wildcats Drilled during Year Indicated** *Number*	*Footage*
1937	13,063,000,000	2,224	8,387,615
1938	15,507,268,000	2,638	8,860,484
1939	17,348,146,000	2,589	8,624,602
1940	18,483,012,000	3,038	10,144,870
1941	19,024,515,000	3,264	11,615,085
1942	19,589,296,000	3,212	12,123,994
1943	20,082,793,000		

* These figures for reserves include the entire United States, but for wildcats they include all states regarded as prospective for oil except New York, Pennsylvania, Eastern Ohio, West Virginia, and Eastern Kentucky.

These figures on reserves were taken from *Facts and Figures*, 7thed., p. 74, published by the American Petroleum Institute, 1941. Figures for reserves as of January 1, 1942, were taken from the Institute *Quarterly* for April, 1942. Figures for January 1, 1943 (December 31, 1942), were taken from the Institute *Quarterly* for April, 1943. The data for wildcats were taken from the articles printed in the A.A.P.G. *Bulletin*, and listed in footnote 3.

Among all the states listed in Table I, there are eleven in which wildcatting has been especially active during the past few years. These eleven are: Arkansas, California, Illinois, Indiana, Kansas, Louisiana, Michigan, Mississippi, New Mexico, Oklahoma, and Texas. Also within this group of 11 states is 95 per cent of the country's proved oil reserves (as of January 1, 1943). It was for these reasons that last year we made a special study of wildcatting in relation to reserves in these states; and this year we shall repeat this survey as it applies to 1942.[7]

Tables IV and V need no particular comments, except that the reader will note that, in Table V, we have contrasted averages for the 5-year period from 1937 to 1941, inclusive, with averages for the overlapping 5-year period of 1938–1942, inclusive.

There are several ways of estimating the degree of success of wildcat drilling. We have called successful those wildcat holes (and the footage drilled in these holes), which were completed as commercial producers. However, we can consider wildcatting in relation to oil reserves discovered by this class of drilling. In Table VI, under A, are recorded the proved reserves as of January 1 in each

[7] Information on proved reserves is taken from the American Petroleum Institute *Quarterly*, in April of each year from 1937 to 1943, inclusive. Information on wildcatting is from papers listed in footnote 3, p. 969.

TABLE V

STATISTICS ON WILDCATS IN AREA OF ELEVEN STATES*

	Located on Technical Basis				Non-Technical Location				Unknown Basis for Location				Total				Grand Totals	Total Footage		Number of Ft. in Dry Holes Drilled Per Foot in Producing Wildcats
	Producers		Dry Holes		Producers		Dry Holes		Producers		Dry Holes		Producers		Dry Holes					
	Number	Per Cent	Number	Per Cent	Number	Per Cent	Number	Per Cent	Number	Per Cent	Number	Per Cent	Number	Per Cent	Number	Per Cent	Wildcats	Producers	Dry Wildcats	
1937	214	16.05	1,119	83.95	17	5.80	276	94.20	48	9.21	473	90.79	279	12.99	1,868	87.01	2,147	1,188,366	7,002,875	5.89
1938	283	17.93	1,295	82.07	43	7.61	522	92.30	17	4.67	347	95.33	343	13.68	2,164	86.32	2,507	1,482,889	7,119,807	4.80
1939	216	13.33	1,404	86.67	43	6.15	656	93.85	10	4.85	196	95.15	269	10.65	2,256	89.35	2,525	1,107,395	7,344,424	6.63
1940	309	15.69	1,660	84.31	35	4.57	731	95.43	11	8.09	125	91.91	355	12.37	2,516	87.63	2,871	1,397,496	8,416,015	6.02
1941	463	20.17	1,832	79.83	29	3.92	710	96.08	0	0	55	100.00	492	15.92	2,597	84.08	3,089	2,023,184	9,222,217	4.55
1942	438	18.25	1,961	81.75	21	3.81	530	96.19	11	12.36	78	87.64	470	12.17	2,569	87.83	3,039	2,094,038	9,597,767	4.58
Total for '37–'41	1,485	16.88	7,310	83.12	167	5.45	2,895	94.55	86	6.70	1,196	93.30	1,738	13.22	11,401	86.78	13,139	7,199,330	39,105,398	5.43
Total for '38–'42	1,709	17.33	8,152	82.67	170	5.12	3,149	94.88	49	5.76	801	94.24	1,928	13.74	12,102	86.26	14,030	8,105,002	41,700,270	5.14

* This area includes California, New Mexico, Texas, Oklahoma, Kansas, Arkansas, Louisiana, Mississippi, Illinois, Indiana, and Michigan. Full statistics were not available on the other producing states.

TABLE VI

STATISTICS ON PROVED RESERVES IN AREA OF ELEVEN STATES*

	1937	1938	1939	1940	1941	1942	1943
A. Proved reserves as of Jan. 1 of year indicated	12,241,885,000	14,664,035,000	16,630,452,000	17,723,393,000	18,226,542,000	18,816,785,000	19,260,415,000
B. Net change in proved reserves since Jan. 1 of previous year		+2,422,150,000	+1,966,417,000	+1,092,941,000	+503,149,000	+590,243,000	+443,630,000
C. New proved reserves discovered during year indicated	896,692,000	805,293,000	337,989,000	280,882,000	423,551,000	254,801,000	
D. New reserves added through extensions and revisions of old fields during year indicated	2,739,254,000	2,313,356,000	1,955,507,000	1,505,816,000	1,496,610,000	1,496,536,000	
E. Total new proved reserves added (C+D)	3,635,946,000	3,118,649,000	2,293,496,000	1,786,698,000	1,920,161,000	1,751,337,000	
F. Production during year indicated	1,213,796,000	1,152,231,000	1,200,555,000	1,283,490,000	1,329,918,000	1,307,707,000	
G. Newly discovered reserves (C) per wildcat hole drilled in year indicated	417,647	321,217	133,857	97,834	137,115	83,843	
H. Newly discovered reserves (C) per foot of wildcat hole drilled in year indicated	109.4	93.6	39.9	28.6	37.7	21.8	
I. New proved reserves (E) per wildcat hole drilled in year indicated	1,693,500	1,243,976	908,315	622,326	621,612	576,287	
J. New proved reserves (E) per foot of wildcat hole drilled in year indicated	443.88	362.52	271.36	182.07	170.75	149.79	

* This area includes Arkansas, California, Illinois, Indiana, Kansas, Louisiana, Michigan, Mississippi, New Mexico, Oklahoma, and Texas. All figures are in barrels.

of the indicated years, and for the eleven-states area under discussion. Under B is shown, for each January first, the net change in estimated proved reserves since the preceding January first, allowing for production during that 12-month period. Under C are the new proved reserves which are directly attributable to wildcat discoveries made during the year.[8] Under D are the revisions and additions of estimated proved reserves in fields already discovered in previous years, these revisions and additions having been made on the basis of new information obtained through development during the year indicated.[8] Under E all the new reserves (C+D) are totalled for each year.

Last year an item was included in Table VI[9] showing the "number of years of remaining supply," a figure derived by dividing the total proved reserves as of January 1 of a given year by the total production of the preceding year. This figure was recorded merely to indicate a trend. However, in the present report it has purposely been omitted since it offers opportunity for serious misunderstanding. The proved oil reserves, estimated as of any given date, can not be withdrawn at whatever desired rate the demands of the moment may require. Oil can not be withdrawn from its reservoirs as water can be dipped from a pond. This is a statement which may sound trite to a petroleum geologist, but it most certainly needs to be impressed on many a layman. To quote from the recently published report of the American Petroleum Institute's Committee on Reserves[10]

> estimates of proved reserves do not reflect availability or rate at which these reserves can be produced with or without physical waste. For instance, arbitrary division of the known reserves by a current rate of production or by an anticipated rate of consumption is obviously incorrect. Oil in the ground cannot be produced at any desired rate for a given period of time. As a matter of fact, today's known oil can be recovered only over a period of many years and at gradually declining annual rates, as has been widely demonstrated by past performance under all kinds of operating conditions.

As we have explained, the reserves in group D might be assigned back to the year of discovery, but due to the present incompleteness of available statistics, this can not readily be done. Instead, we may regard both groups of new reserves (C and D) as directly and indirectly resulting from original wildcat discoveries. If, for each year, we divide the newly discovered proved reserves (C, Table VI) by the number of wildcats drilled in that year, or by the total wildcat footage drilled in that year, we shall have a measure of the degree of success of wild-

[8] Because 40-acre spacing was required in field development in 1942, as contrasted with 20-acre and 10-acre spacing in many areas in previous years, there was a relative increase in the factor of area in estimating proved, or "blocked out," reserves as of December 31, 1942 (January 1, 1943); and this tendency was of course more effective in those fields where considerable development occurred than in those where, after discovery, possibly only one or two additional wells were drilled. The effect of the spacing rule on the estimate of proved reserves related to the discovery well alone, where further development had not been undertaken during the year, was practically nil. Consequently, in the estimates of proved reserves, as of December 31, 1942, the reserves due to extensions were relatively larger in comparison with the reserves attributed to new discoveries than in previous years.

[9] *Bull. Amer. Assoc. Petrol. Geol.*, Vol. 26 (1942), G, Table VI, p. 978.

[10] Special release; but to be included in the Institute's *Quarterly* for April, 1943.

catting in terms of newly discovered proved reserves (G and H, Table VI); and if we divide the total new proved reserves (discoveries plus revisions plus extensions: E, Table VI) by the number of wildcats drilled, or by the total wildcat footage drilled, we shall have a measure of the degree of success of wildcatting assisted by outpost drilling (I and J, Table VI). Under G and H the measure is short. Under I and J, the measure may be too large or too small. In any case, there is an unavoidable error in estimating *rate of discovery*, or degree of success in wildcatting, measured in terms of new reserves; but the figures obtainable by these methods, as here described, are a significant index. As shown graphically in Figure 4, they reveal a marked drop in the rate of discovery through the years 1937 to 1942, and this in spite of a steadily increasing footage drilled in wildcats and, except in 1942, an increasing number of wildcats drilled in each year. From 109.4 barrels of new reserves discovered per foot of wildcat drilled in 1937 there has been a drop to only 21.8 barrels per foot of wildcat drilled in 1942. For all the states included in Figure 1 and in Table I the corresponding drop has been from 110.7 barrels in 1937 to 21.4 barrels in 1942, per wildcat hole. If we take into consideration only producer wildcats, there has been a drop from 3,305,131 barrels of newly discovered reserves in 1937 to 528,559 barrels in 1942, per discovery wildcat (including *all* producing wildcats).

The seriousness of this decline in the success of wildcatting has been widely stressed, and reasons for it have been explained. The principal reason, as we stated last year, lies in the fact that new geological traps for oil are becoming increasingly difficult to find because (1) they are fewer, (2) they are deeper, (3) they are associated with less pronounced geological structures, and (4) low-permeability sands, formerly overlooked, are now being exploited. Based on experience to date we may say that, to step up the rate of discovering new reserves, an increasing number of wildcats must be drilled each year, and the holes drilled must be carried to greater depths than formerly, wherever the deeper stratigraphic section holds any promise whatever. "If we are to maintain a satisfactory discovery rate, as applied to new reserves, we must become more vigorous than heretofore in our wildcatting campaign."

These were our words a year ago. They reiterate the opinion of the entire oil fraternity. They express the warnings and recommendations of the Petroleum Administration for War, and its predecessor, the Office of Petroleum Coördinator. To heed them is of the utmost importance during this period of large and growing war demands. Then why were fewer wildcats drilled in 1942 than in 1941? There were several reasons. First, as is almost universally recognized by the oil fraternity, the price for crude was too low to encourage taking the obvious increased risks of wildcatting. Second was the reduction in skilled labor for drilling. Third, there was the doubt as to whether, if oil were discovered, enough pipe and other necessary equipment would be available to take care of the ensuing offset requirements and continuous-drilling requirements of the lease contract. Fourth, there was the question, in many areas, whether oil, if found, could be transported for

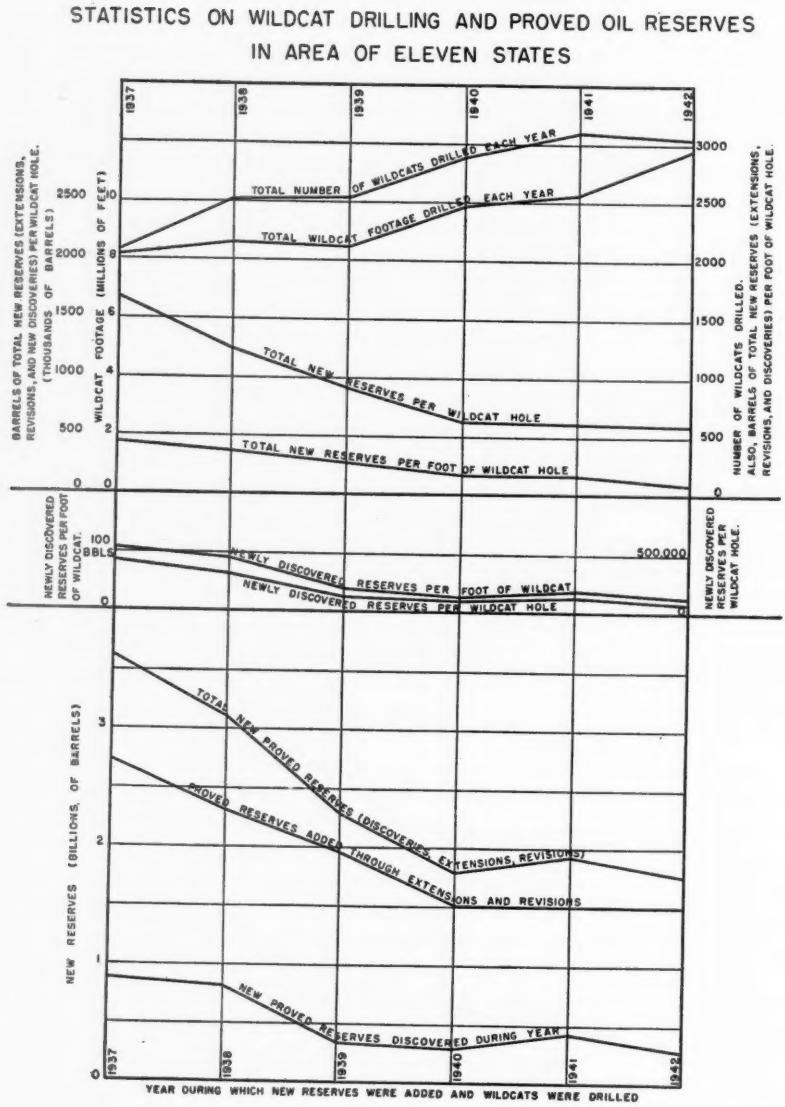

STATISTICS ON WILDCAT DRILLING AND PROVED OIL RESERVES
IN AREA OF ELEVEN STATES
1937
1938
1939
1940
1941
1942
TOTAL NUMBER OF WILDCATS DRILLED EACH YEAR
TOTAL WILDCAT FOOTAGE DRILLED EACH YEAR
TOTAL NEW RESERVES PER WILDCAT HOLE
TOTAL NEW RESERVES PER FOOT OF WILDCAT HOLE
BARRELS OF TOTAL NEW RESERVES (EXTENSIONS, REVISIONS, AND NEW DISCOVERIES) PER WILDCAT HOLE. (THOUSANDS OF BARRELS)
WILDCAT FOOTAGE (MILLIONS OF FEET)
NUMBER OF WILDCATS DRILLED. ALSO, BARRELS OF TOTAL NEW RESERVES (EXTENSIONS, REVISIONS, AND DISCOVERIES) PER FOOT OF WILDCAT HOLE.
NEWLY DISCOVERED RESERVES PER FOOT OF WILDCAT.
NEWLY DISCOVERED RESERVES PER FOOT OF WILDCAT
NEWLY DISCOVERED RESERVES PER WILDCAT HOLE
500,000
NEWLY DISCOVERED RESERVES PER WILDCAT HOLE.
TOTAL NEW PROVED RESERVES (DISCOVERIES, EXTENSIONS, REVISIONS)
PROVED RESERVES ADDED THROUGH EXTENSIONS AND REVISIONS
NEW PROVED RESERVES DISCOVERED DURING YEAR
NEW RESERVES (BILLIONS OF BARRELS)
YEAR DURING WHICH NEW RESERVES WERE ADDED AND WILDCATS WERE DRILLED

FIG. 4

refining and utilization. These factors have served to weaken the exploration effort as applied to wildcat drilling. And there are other factors which will still further impede the wildcatting program unless they are corrected in time. Such, for instance, are (1) the continuing reduction of technical staffs composed of those who are indispensable in the several phases of exploration for oil; (2) the deterioration of drill pipe and other equipment used in drilling, and the consequent twist-offs and breakage, especially in deep holes; and (3) concern as to the continuation of the oil man's percentage depletion allowance which serves as an incentive for wildcatting.

These factors which militate against an expansion of the wildcatting program are well known. They have been widely expounded. Their significance must somehow be driven home in the minds of those who control them and who can correct them, for otherwise it is doubtful whether enough wildcats will be drilled in 1943 even to approach the 4,500 urgently recommended by the Petroleum Administration for War and by all those who realize the urgency of searching for more oil reserves. Toward this end it is essential that two facts be thoroughly appreciated—two facts which are vital to an adequate understanding of this whole problem of wildcatting and reserves. The first, already discussed, is the fact that the rate at which oil can be withdrawn from its natural reservoir is limited; and the second is the fact that there is bound to be a considerable period of time elapsing between geological or geophysical exploration for oil and discovery of oil, and between discovery of oil and developed exploitation.

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VOL. 27, NO. 6 (JUNE, 1943), PP. 730-738, 1 FIG.

REVIEW OF DEVELOPMENTS IN 1942, GULF COAST OF UPPER TEXAS AND LOUISIANA[1]

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ABSTRACT

The area covered by this report includes the trends along which production is established from the downdip Wilcox and the Cockfield of Eocene age, the *Marginulina*-Frio section of Oligocene age, and the undifferentiated Miocene. Exploratory activities during 1942 covered all parts of this large province but were concentrated along the Wilcox trend in Texas and the Miocene in Louisiana. Geophysical exploration, chiefly seismograph and gravity meter, has had probably its most intensive use in the district. Drilling activities declined, however, as was to be anticipated, wildcat drilling falling to 164 operations in 1942, as compared with 189 in 1941, and field drilling declining from 1,433 to 800 wells. The over-all quality of new discoveries, which decreased from 30 in 1941 to 22 in 1942, was distinctly unfavorable, only three being regarded as having first class possibilities. As has been the case in recent years, extensions, new sands, and routine development in proved fields have furnished more new reserves than the discoveries.

INTRODUCTION

Analysis of 1942 developments in the Texas-Louisiana Coastal area serves to accent once again the unfavorable ratio of newly discovered reserves to the exploratory effort expended. It is true that wildcat drilling decreased 19 per cent as compared with the previous year, but discoveries declined 27 per cent and in quality they were probably the poorest in the history of the district. Only one, the Mercy field, in San Jacinto County, Texas, appears at present to be a first class pool, although it is probable that the discovery of deep flank production at Avery Island salt dome in Iberia Parish, and of multi-sand gas-distillate accumulation at Krotz Springs, St. Landry Parish, Louisiana, will be important. The poor results of the 1942 exploratory campaign appear to be attributable in part to the fact that most of the large, easily found structures have been previously localized by geophysical methods and discovered by drilling, but, more importantly in this writer's opinion, to the relatively poor trends along which Gulf Coast operators are being forced to prospect. On the downdip Wilcox trend in Texas, which has received major attention for the past 2 years, accumulation southwest of San Jacinto County has so far been essentially gas-distillate. This same situation is generally true along the downdip Oligocene trend in both Texas and Louisiana. The pertinence of this observation is reflected in the fact that of last year's 22 discoveries, 12 areas were productive of gas or gas-distillate. This is not to say that some of these distillate producing areas will not be commercially attractive, but in the main they will be at best marginal and, because of low per-acre-foot recoveries in distillate reservoirs, the crude reserves established in these fields will be small as compared with normal low-ratio producing areas.

[1] Presented by title before the Association at Fort Worth, April 7-9, 1943. Manuscript received, March 17, 1943.

[2] Pan American Production Company. The writer acknowledges with thanks the assistance and coöperation of W. M. Angle and J. R. Graham who collected and assembled many of the data used in this review, and of Mrs. Jerry Poutra who drafted the accompanying map.

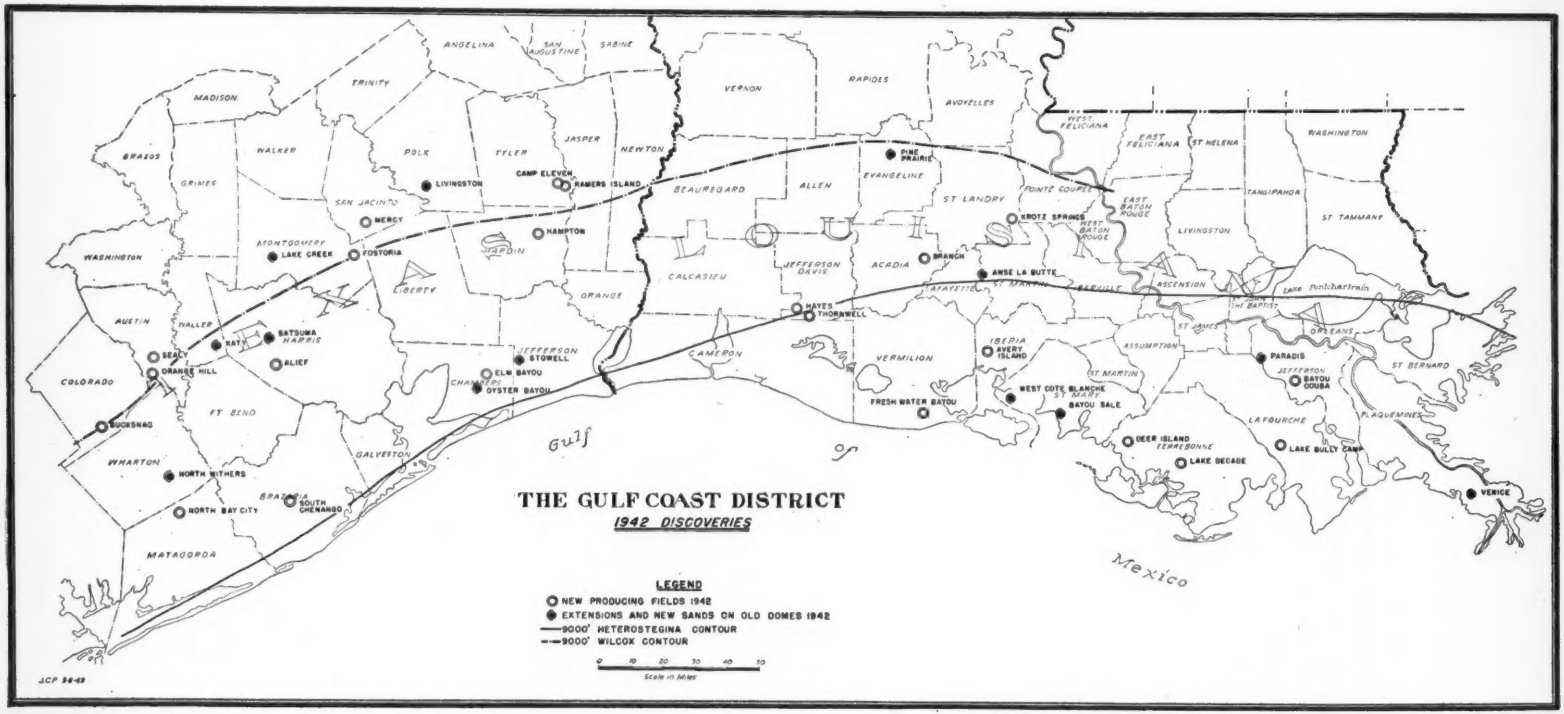

THE GULF COAST DISTRICT
1942 DISCOVERIES
LEGEND
NEW PRODUCING FIELDS 1942
EXTENSIONS AND NEW SANDS ON OLD DOMES 1942
9000' HETEROSTEGINA CONTOUR
9000' WILCOX CONTOUR
Scale in Miles
Gulf of Mexico
LOUISIANA
ANGELINA
SAN AUGUSTINE
SABINE
TRINITY
MADISON
BRAZOS
WALKER
GRIMES
POLK
TYLER
JASPER
NEWTON
SAN JACINTO
MONTGOMERY
WASHINGTON
AUSTIN
WALLER
COLORADO
FT BEND
WHARTON
MATAGORDA
BRAZORIA
GALVESTON
LIBERTY
CHAMBERS
JEFFERSON
ORANGE
HARDIN
CALCASIEU
CAMERON
VERNON
RAPIDES
AVOYELLES
BEAUREGARD
ALLEN
EVANGELINE
JEFFERSON DAVIS
ACADIA
VERMILION
ST LANDRY
LAFAYETTE
ST MARTIN
IBERIA
ST MARY
IBERVILLE
POINTE COUPEE
WEST FELICIANA
EAST FELICIANA
ST HELENA
WASHINGTON
EAST BATON ROUGE
WEST BATON ROUGE
LIVINGSTON
TANGIPAHOA
ST TAMMANY
ASCENSION
ASSUMPTION
ST JAMES
ST JOHN THE BAPTIST
ORLEANS
JEFFERSON
ST BERNARD
PLAQUEMINES
LAFOURCHE
TERREBONNE
LAKE PONTCHARTRAIN
LIVINGSTON
CAMP ELEVEN
RABBS ISLAND
MERCY
HAMPTON
LAKE CREEK
FOSTORIA
SEALY
ORANGE HILL
KATY
BATSUMA
HARRIS
ALIEF
JEFFERSON
STOWELL
ELM BAYOU
OYSTER BAYOU
BUCKSNAG
NORTH WITHERS
NORTH BAY CITY
SOUTH CHENANGO
PINE PRAIRIE
KROTZ SPRINGS
BRANCH
ANSE LA BUTTE
HAYES
THORNWELL
AVERY ISLAND
FRESH WATER BAYOU
WEST COTE BLANCHE BAY
BAYOU SALE
PARADIS
BAYOU GOUBA
DEER ISLAND
LAKE DECADE
LAKE BULLY CAMP
VENICE
JCP 58-49

FIG. 1

During the past year or so it has been suggested that the law of diminishing returns has become operative with respect to the use of presently accepted geophysical methods in searching for new structures. Be that as it may, the fact remains that the majority of the exploratory tests in 1942 were drilled on geophysical prospects and, with the single possible exception of Avery Island, all of the year's discoveries should be credited to the seismograph and gravity meter. The relatively poor quality of 1942 discoveries is chargeable of course, not to the geophysical method involved in structure finding, but to the second rate trends along which they were largely used. Indicative of the industry's apparent opinion as to the future possibilities of the various trends is the break-down of a total of 3,298 geophysical crew weeks for the year which indicates 55 per cent of the work conducted along the Eocene trend, 28 per cent in the Miocene, and 17 per cent in the Oligocene.

UPPER COASTAL TEXAS

EXPLORATION

Geophysical exploration totaling 1,892 crew weeks was localized 80 per cent along the Eocene belt (60 per cent Wilcox and 20 per cent Cockfield) and 20 per cent in the Oligocene trend. (In general, there is no Miocene trend in the Texas Gulf Coast which is comparable with the marine Miocene belt in Louisiana.) Wildcats which were subsequently drilled were divided 75 per cent Eocene (38 per cent Wilcox and 37 per cent Cockfield) and 25 per cent Oligocene. Discoveries resulting from this drilling were allocated as follows: Wilcox, 4; Cockfield, 5; Oligocene, 3.

TABLE I

RESULTS OF WILDCAT DRILLING

Year	*Wildcats Drilled*	*Dry Holes*	*Discoveries*	*Ratio*
1941	119	106	13	1:9.2
1942	108	96	12	1:9.0

TABLE II

FIELDS DISCOVERED IN 1942

Field Name	*County (Parish)*	*Operator*	*Producing Formation*	*Depth of Discovery Sand (Feet)*	*Initial Prod. (Bbls. Per Day)*	*Choke (Inch)*	*Gas-Oil Ratio*
Alief	Harris	Pure	Cockfield (Eocene)	7,920–7,930	54 Dist.	5/16	61,760
Buck Snag	Colorado	Shell	Cockfield (Eocene)	6,121–6,151	156, 30% SW.	1/4	27,058
Camp Eleven	Tyler	Republic-Houston	Wilcox (Eocene)	7,999–8,013	612	1/4	951
Chenango, South	Brazoria	Stanolind	Frio (Oligocene)	10,010–10,025	50 Dist.	1/4	112,000
Elm Bayou	Chambers	Sun	Frio (Oligocene)	8,214–8,230	139	1/8	585
Fostoria	Montgomery	Atlantic	Cockfield (Eocene)	5,786–5,794	250, 60% SW.	Pump	410
Hampton	Hardin	Republic-Houston	Cockfield (Eocene)	6,951–6,954(?)	517	1/4	716
Mercy	San Jacinto	Shell	Wilcox (Eocene)	8,255–8,294	583	1/4	771
North Bay City	Matagorda	Ohio	Frio (Oligocene)	7,865–7,882	310	1/8	578
Orange Hill	Austin	Ohio	Wilcox (Eocene)	9,050–9,160	139 Dist.	3/8	49,763
Ramers Island	Tyler	Republic-Houston	Cockfield (Eocene)	5,395–5,401	21 Dist.	5/32	30,846
Sealy	Austin	Shell	Wilcox (Eocene)	8,720–8,820	80 Dist.	5/16	75,280

Most of last year's discoveries are still one-well fields, the initial well having been followed either by dry holes or a lack of drilling occasioned probably by the quality of the discovery well. Of the twelve new areas brought into production, only one, Mercy, holds promise of major reserves. At the close of the year, 14 oil wells and one dry hole had been completed and the producing area was 2 miles long northeast and southwest and $\frac{3}{4}$ mile wide. Accumulation is in the top of the Wilcox sand section on a structure which is closed against the south side of a fault downthrown on the south. These structural conditions are typical of those which control practically all of the Wilcox accumulation in this district. Since no deep test has been drilled, the lower Wilcox potentialities, which are considered attractive, are unknown. *Camp Eleven*, also a Wilcox discovery, probably will develop into a better field than its present slow development would suggest. At the year's end, two offsetting oil wells had been completed in the top of the Wilcox, at which point development ceased for the time being. *Orange Hill* and *Sealy*, the two remaining Wilcox fields, are both productive of gas-distillate with no additional tests drilled since the completion of their discovery wells.

Cockfield exploration was rewarded with five discoveries but none of these gives evidence of establishing substantial reserves. The *Alief* area is productive of gas-distillate from a thin sand in the Yegua and has to its credit two dry holes as well as the discovery well. At *Buck Snag* the first and only well is a high-ratio producer in the upper Cockfield, probably the result of an imperfect completion in a sand containing gas and salt water with an intervening thin oil column. *Fostoria* was drilled originally as a Wilcox prospect but after finding salt water in the objective formation, the well was plugged back and completed as a light producer from a sand, possibly a stray, in the Yegua section. Because detailed information has not been released, little is known regarding *Hampton* and *Ramers Island*. In each area one producer and one dry hole have been drilled.

Along the Oligocene belt, *South Chenango* produces gas-distillate from a sand about 2,000 feet in the Frio formation, and *Elm Bayou* is oil productive from a thin shaly sand near the top of the Frio. In neither of these areas have second wells been drilled. *North Bay City* has four oil wells completed in a sand approximately 1,300 feet below the top of the Frio and may represent a more important reserve than is at present apparent. Lack of essential data precludes an intelligent estimate at this time.

EXTENSIONS AND NEW SANDS

Routine development, extensions, and new sands have probably added more proved reserves than new discoveries. Among the more notable are: *Oyster Bayou*, Chambers County, where 8 additional wells have materially added to reserves and aided in clarifying the complicated structural conditions; *Satsuma*, Harris County, an old field producing from the Cockfield where deeper drilling found substantial production in a 15-foot sand 450 feet below the original producing

level; *Stowell*, Jefferson County, where 12 producers were completed; and *North Withers*, Wharton County, which received 60-odd completions during the year. Deeper drilling in the old *Livingston* field, Polk County, resulted in the discovery of Wilcox accumulation, although its importance is still unknown, and the completion of the second deep test as a Sparta sand producer, the first in Texas, after the well had found salt water in the objective Wilcox formation. The importance of *Lake Creek*, Montgomery County, as a relatively low ratio gas-distillate reserve was further emphasized during 1942 with the completion of 8 wells in various sands of the Wilcox formation, one of which is producing from 11,700 feet, the deepest Wilcox production so far found. Another significant *Lake Creek* development was the completion of Superior's Frost No. 1, extending the field

DEVELOPMENT AND PRODUCTION

TABLE III

DEVELOPMENT AND PRODUCTION STATISTICS*

TEXAS

	1938	*1939*	*1940*	*1941*	*1942*
Number of field-wells drilled	1,415	1,184	1,071	639	356
Annual production (000, omitted)	74,196	79,509	79,786	91,363	91,340
Cumulative production (000, omitted)	1,132,101	1,211,610	1,315,243	1,386,615	1,489,107

* Data from *Oil Weekly* Yearbook—Forecast Numbers for years 1939 to 1943.

2½ miles northeast. Probably the most important development in areas previously proved was at *Katy*, Waller County, which was extended 1½ miles southeast and 3 miles northeast. Prior to these extensions the field had ranked as one of the largest known reserves of gas and distillate by virtue of its multiplicity of producing sands and its large area. With these new extensions the reserve is now estimated at several trillion cubic feet of gas and more than 100 million barrels of recoverable distillate. A large cycling plant has been constructed and is now in operation.

The chief significance to be attached to the figures in Table III is the increase or maintenance of annual production rates through the past 5 years in spite of a steadily declining number of new field wells drilled each year. This undoubtedly is a result of the rigid proration of production which has been in effect in Texas for the past decade. An obvious effect of proration is of course a marked extension of the producing life of a well, so that fewer wells need be drilled to maintain a prorated rate of flow.

The estimated future recoverable crude reserves for the upper Texas Gulf Coast at December 31, 1942, were 2,760,093,000 barrels,[3] an amount sufficient for 30 years' supply at present rates of production.

[3] *Oil and Gas Jour.* (January 28, 1943).

COASTAL LOUISIANA

EXPLORATION

Geophysical exploration in this part of the district, including both seismograph and gravity meter, totaled 1,274 crew weeks as compared with 1,247 crew weeks in 1941. A break-down of this work indicates that chief emphasis was placed upon the Miocene trend which received 57 per cent of the geophysical work. The balance was divided between the Cockfield-Sparta-Wilcox (Eocene) and the Oligocene which received 29 per cent and 14 per cent, respectively. Of the ten discoveries for the year, six were in the marine Miocene belt and four along the Oligocene trend. There were no Eocene discoveries.

TABLE IV

RESULTS OF WILDCAT DRILLING

Year	*Wildcats Drilled*	*Dry Holes*	*Discoveries*	*Ratio*
1941	70	53	17	1:4.1
1942	56	46	10	1:5.6

TABLE V

FIELDS DISCOVERED IN 1942

Field Name	*County (Parish)*	*Operator*	*Producing Formation*	*Depth of Discovery Sand (Feet)*	*Initial Prod. (Bbls. Per Day)*	*Choke (Inch)*	*Gas-Oil Ratio*
Avery Island	Iberia	Humble	Miocene	8,922–9,012	288	5/32	718
Bayou Couba	St. Charles	Gulf	Miocene	6,532–6,542	186	9/64	418
Branch	Acadia	Union Sulphur	Oligocene	*			
Deer Island	Terrebonne	Humble	Miocene	9,562–9,593	5,743 MCF	1/4	Dry gas
Fresh Water Bayou	Vermilion	Union Oil Co. of Calif.	Miocene	11,117–11,134	**		
Hayes	Calcasieu	Gulf	Oligocene	11,617–11,668	61 Dist.	7/32	7,400
Krotz Springs	St. Landry	Gulf	Oligocene	9,265–9,331	358 Dist.	5/16	16,100
Lake Bully Camp	La Fourche	Gulf	Miocene	997–1,000	750 MCF	1/4	Dry gas
Lake Decade	Terrebonne	Superior of Calif.	Miocene	10,192–10,232	454	11/64	549
Thornwell	Jefferson Davis	Cities Service	Oligocene	9,626–9,644	41	5/32	50,750

* Log of well indicates gas-distillate sands, 9,510–9,530; 10,004–10,014; 10,410–10,420 feet. Well blew out, producing 2,127 barrels of distillate and estimated 85,000 M.C.F. per day through four 4-inch flow lines. Exact producing depth unknown.

** No gauge. Shut-in gas-distillate well.

Of the ten discoveries in Coastal Louisiana, only two have had second wells drilled and both of these operations resulted in dry holes. Part of this delay in additional development was caused by the fact that half of the discovery completions came in the last quarter of the year, leaving insufficient time for the drilling of new deep wells, but another factor, as in Texas, was the very poor quality of most of the discoveries, a circumstance which undoubtedly inclined the operators toward a conservative and cautious appraisal of the advisability of additional drilling. *Avery Island* is one of two Louisiana coastal discoveries which appear to have major possibilities, and interestingly enough, it is the only discovery which should be credited to subsurface geological studies rather than geophysical investigations. This Miocene discovery is located on the southwest flank of the Avery Island salt dome with accumulation controlled by the wedging-out of the reservoir sand against domal material. Because of the recognized erratic nature of oil accumulation on salt-dome flanks, many more wells must be

drilled at Avery Island before an intelligent picture of the productive area can be obtained, but the presence of 78 net feet of oil sand in the discovery well suggests strongly that important reserves will be developed on this dome. *Lake Decade,* another Miocene discovery, should still be classed as an unknown quantity. The first well found 40 feet of oil sand which is impressive, but the second test resulted in a dry hole. Correlation of the electrical logs of these two wells indicates that the structure will be complexly faulted and, for that reason, probably difficult to develop without a rather high dry-hole hazard. The remaining four Miocene discoveries at present have little to indicate important reserves The first well at *Bayou Couba* was completed in only 10 feet of oil sand and, after producing for about 2 months, was standing temporarily abandoned at the end of the year. A second test found the top of the salt 450 feet higher than in the discovery but was a dry hole. *Fresh Water Bayou* appears uneconomic at present, the first and only well being completed as a high-ratio distillate producer, shut in for lack of market, from 17 feet of sand below 11,000 feet. *Deer Island* and *Lake Bully Camp* are both productive of dry gas, the former from 31 feet of sand at considerable depth and the latter from a shallow 3-foot stringer. The *Lake Bully Camp* discovery, however, proved the presence of a long suspected salt dome in a general area where prolific Miocene production is obtained on both shallow and deep domes, and may eventually develop into a major producing area.

Intelligent appraisal of the Oligocene discoveries is rendered difficult because each field has only one well, productive of distillate from relatively deep sands. The most outstanding of these areas, at least on the basis of information gained from the first well, appears to be *Krotz Springs* where six zones totaling 180 feet of net sand in the Oligocene contains gas and distillate as does also a 45-foot sand in the top of the Cockfield. Completion was effected in the basal Oligocene sand. Correlation of the log of the discovery well indicates a large uplift, probably a deep salt dome, and it is probable that under a cycling program *Krotz Springs* will develop into an attractive major reserve of both gas and distillate. *Branch* is another Oligocene producing area with potentialities of which little is known although it apparently is not in a class with *Krotz Springs.* The thinness of the sands containing gas and distillate, and their excessive depth combine to make the field look distinctly second class. *Hayes* was proved as a producing area in the summer of 1941 when the Gulf's first well blew out and caught fire. However, the first conventional completion came in 1942 in a broken section containing 43 feet of net sand at 11,600 feet. Here, also, the relatively small amount of sand and the great depth involved, coupled with the fact that the field is located along a trend which has been disappointing, combine to give the discovery a rather low rating. *Thornwell,* being southeast and downdip from Hayes, is also in an indifferent trend as indicated by the findings in the first well. The reservoir, in the upper Oligocene, is only 18 feet thick and is productive of gas and distillate with a high gas-oil ratio.

EXTENSIONS AND NEW SANDS

Several coastal Louisiana fields were extended importantly during the past year, probably the most outstanding being *Paradis*, St. Charles Parish, which had 31 completions. This drilling extended the producing area tremendously to the southwest, northeast, and east and of course vastly increased the proved reserves. The second most important field from the standpoint of development was *Bayou Sale*, St. Mary Parish, where 19 new wells extended the field in all directions and defined it on the north. An interesting development in this area is a well which The Texas Company completed about midway between *Bayou Sale* and *Horseshoe Bayou*, about 3 miles south. Information from this well suggests the possibility that these two fields are on the same major structural uplift and may eventually be found to join. Development at *Venice*, Plaquemines Parish, continued with 9 wells being drilled, extending the producing area on the north and west flanks and materially increasing the proved reserves. *West Cote Blanche*,

DEVELOPMENT AND PRODUCTION

TABLE VI

DEVELOPMENT AND PRODUCTION STATISTICS*

LOUISIANA

	1938	*1939*	*1940*	*1941*	*1942*
Number of field-wells drilled	503	740	973	794	444
Annual production (000, omitted)	66,877	69,007	80,078	91,455	90,251
Cumulative production (000, omitted)	392,054	461,061	546,856	630,588	717,923

* Data from *Oil Weekly* Yearbook—Forecast Numbers for years 1939 to 1943.

St. Mary Parish, at the end of the year had a considerably increased reserve as a result of 7 completions which extended the producing area west, north, and east. *Pine Prairie*, Evangeline Parish, which was a 1941 discovery in the Cockfield on the east flank of the dome, was extended 1½ miles across the dome when The Texas Company developed Sparta production on the southwest flank. However, wells subsequently drilled to this new producing zone have revealed the Sparta sands as being thin and of low permeability and their economic importance is questionable. During the year deep Oligocene production was found on the north flank of *Anse La Butte*, Lafayette Parish, a piercement-type dome which has produced prolifically from shallow Miocene sands in a limited area. Since only one well has been completed this extension can not be intelligently rated but it will probably be important.

Comparison of these figures with those in Table III indicates that whereas the peak in field drilling was reached in the Texas Gulf Coast in 1938, this same peak, because of the lag in development, was not reached in Coastal Louisiana until 1940. Since that time field operations have steadily declined, but, taking into consideration the relatively high per well rate of flow, Louisiana's annual pro-

duction has behaved very creditably, being maintained the last 2 years in spite of a marked decline in field drilling. It is questionable, however, if this favorable condition can be maintained through many more years unless the discovery rate and quality are improved, and the drilling of additional wells in presently proved areas is accelerated.

The estimated future recoverable crude reserves in Coastal Louisiana at December 31, 1942, were 886,239,000 barrels,[4] sufficient for 10 years' supply at 1942 rates of flow.

CONCLUSIONS

In view of the unfavorable discovery trend which set in several years ago in Coastal Texas and Louisiana and which has been accentuated in 1942, it seems permissible to infer that the large, more or less easily found crude reserves in the district are now known. Without doubt, many new producing areas will be located, but, in the light of recent years' histories, the majority will probably be at rather great depths, from relatively poor sands, and of questionable economic importance as measured by standards of to-day. Until results are poorer than they have been to date, presently known geophysical methods will be used extensively but the time must be approaching, if not already in sight, when present techniques for oil finding will prove inadequate when results are compared with cost.

An ever increasing area, particularly in the upper Texas Gulf Coast, has been so intensively prospected that there are now sufficient accurate subsurface data to permit detailed stratigraphic studies. Reserves eventually found by this approach will undoubtedly be important, especially on the flanks of presently known and outlined piercement-type salt domes. For a variety of reasons, however, intensive exploration on salt-dome flanks is very costly and may be delayed until crude prices are more nearly commensurate with finding costs than is now the case. In areas apart from salt domes, Gulf Coast geologists are becoming more and more conscious of the possibilities of stratigraphic traps such as old shore lines, either associated or unassociated with local structural disturbances. The subsurface section encountered throughout the area is peculiarly susceptible to studies of this nature because of the extreme lenticularity of most of the sands. Exploration for reserves of this kind, however, requiring the drilling of many wells, is also costly and probably will not receive its greatest impetus until crude prices are adjusted materially upward.

Although the Coastal Texas and Louisiana district has accounted for 5,858,362,000 barrels of crude, either produced or proved, there remains in the aggregate much additional oil to be discovered, particularly as national oil reserves decline and sufficient incentive is offered to justify the costly exploration entailed. The easily found reserves are proved and drilled; the difficult task lies ahead.

[4] *Oil and Gas Jour.* (January 28, 1943).

BULLETIN OF THE AMERICAN ASSOCIATION OF PETROLEUM GEOLOGISTS
VOL. 27, NO. 6 (JUNE, 1943), PP. 739-746, 1 FIG.

DEVELOPMENTS IN SOUTH TEXAS IN 1942[1]

FRITH C. OWENS[2] AND E. A. TAEGEL[3]
Corpus Christi, Texas

ABSTRACT

In 1942, development in South Texas was curtailed due to uncertain conditions in the oil industry. Lack of material and transportation facilities resulted in non-development of proved leases, together with less exploration.

Activity increased along the Wilcox trend, and the general wildcatting policy favored the drilling of large blocks; geophysics is largely influential.

The increased reserves in South Texas have come from the development of known fields. Reserves added by new discoveries are very small.

No new recycling plants were built, but the capacity of several of the older was increased to include the recovery of butane.

INTRODUCTION

The area covered in this report is large, and due to various producing conditions, it is believed necessary to divide the territory into stratigraphic divisions based on geologic age rather than on geographic limits. This is due not only to the numerous producing sands in South Texas, but also to the fact that production is found in the same formations in more than one district. New discoveries, therefore, are listed by counties and formational age or trend.

These stratigraphic divisions were defined by Kidd in an earlier development paper.[4]

These subdivisions are: (1) the Ordovician and Pennsylvanian of the Edwards Plateau; (2) the Cretaceous in the fault line; (3) the Wilcox, Carrizo, Queen City and Sparta in the Lower Eocene trend; (4) the Yegua and Jackson of the Upper Eocene; (5) the Frio-Vicksburg of basal Oligocene age; and (6) the Upper Oligocene and Lower Miocene of the Coastal area, including the *Marginulina*-Frio, Catahoula, and Oakville.

No attempt is here made to define these subdivisions or their various producing sands.

DEVELOPMENT

Exploration in South Texas in 1942 resulted in the discovery of 31 fields. These are shown in Table I and their geographical position in Figure 1.

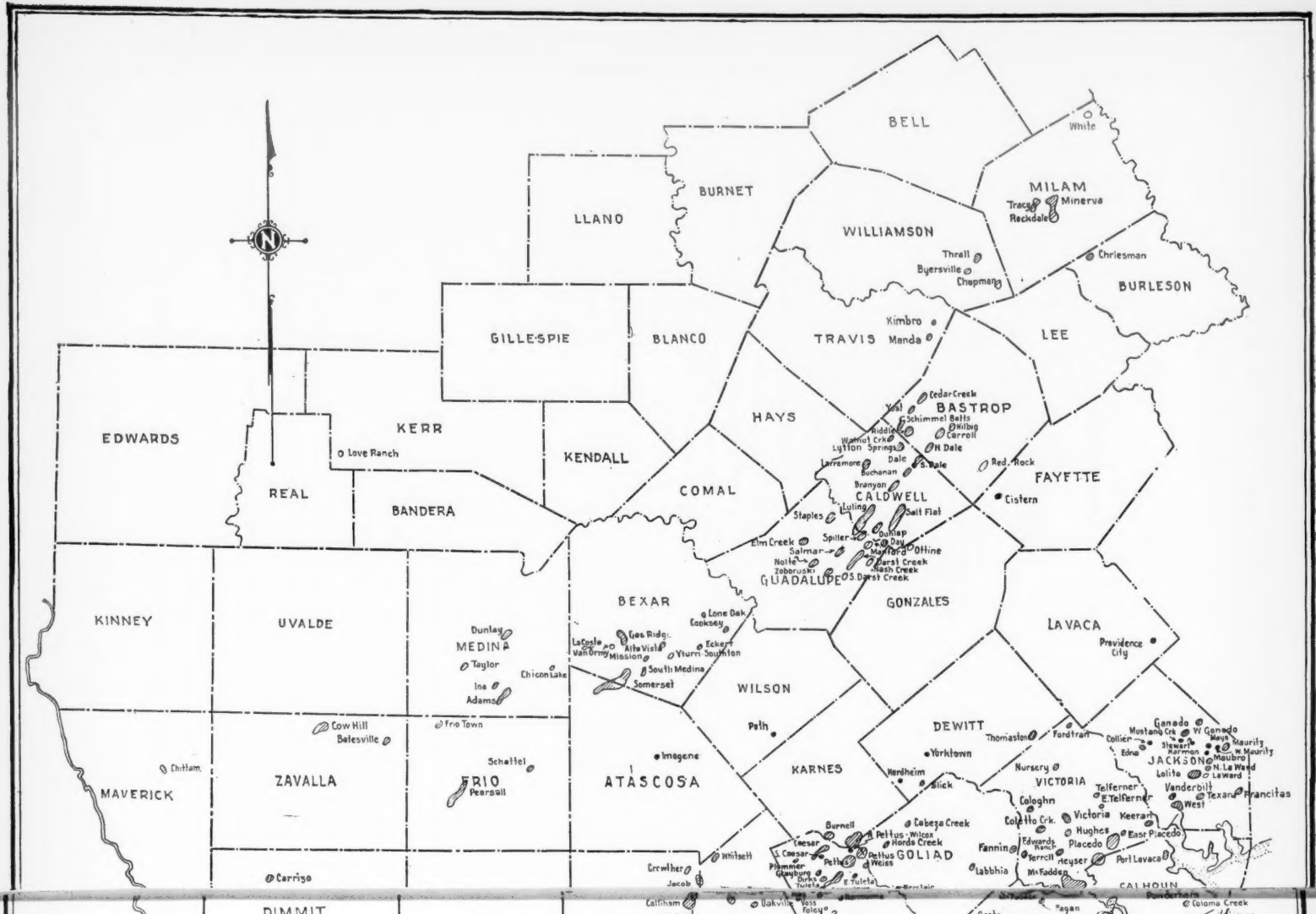
Field development and wildcat drilling showed a marked decline. The total amount of drilling was reduced 45 per cent. This was due largely to uncertain marketing, loss of water-carrier facilities, and lack of pipeline outlets. Nominations and allowables were based primarily on crude oil with a high-octane aviation-gasoline rating. Fields producing lower-octane crudes were given very low

[1] Presented by title before the Association at Fort Worth, April 7–9, 1943. Manuscript received, May 5, 1943.

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[4] Gentry Kidd, "Developments in South Texas, 1938–1939," *Bull. Amer. Assoc. Petrol. Geol.*, Vol. 23, No. 6 (June, 1939), pp. 860–70.


BELL
White
MILAM
Tracy
Minerva
Rockdale
BURNET
LLANO
WILLIAMSON
Thrall
Byersville
Chapman
Chriesman
BURLESON
GILLESPIE
BLANCO
TRAVIS
Kimbro
Manda
LEE
EDWARDS
KERR
Love Ranch
HAYS
Yost
Cedar Creek
BASTROP
Schimmel Belts
Wilbig
Carroll
Riddle
Walnut Crk
Lytton Springs
N Dale
Larremore
Dale
S. Dale
Red Rock
Buchanan
KENDALL
REAL
BANDERA
COMAL
Branyon
CALDWELL
Luling
Staples
Salt Flat
FAYETTE
Cistern
Elm Creek
Spiller
Dunlap
Day
Salmar
Maxford
Ottine
Nolte
Zoberuski
Marsh Creek
Nash Creek
S. Darst Creek
GUADALUPE
KINNEY
UVALDE
BEXAR
Lone Oak
Cookseys
Dunlay
MEDINA
LaCoste
Lee Ridge
Alta Vista
Van Ormy
Mission
Eckert
Yturri
Scanlon
Taylor
Ina
Adams
Chicon Lake
South Medina
Somerset
GONZALES
LAVACA
Providence City
WILSON
Poth
DEWITT
Thomaston
Fordtran
Yorktown
Nordheim
Slick
Nursery
Ganado
Mustang Crk
W Ganado
Mauvo
Collier
Edna
Stewart
Kerman
Maurity
W Maurity
JACKSON
Maubro
N. La Ward
Lolita
Leward
Vanderbilt
Texana
Francitas
West
Telferner
Cologne
Victoria
Keerans
Colletto Crk.
Hughes
East Placedo
Edwards Ranch
Placedo
Fannin
Ferrich
Meyser
Port Lavaca
Labbhia
McFadden
CALHOUN
Powderhorn
Coloma Creek
Pagan
Cow Hill
Batesville
Frio Town
Schattel
Chittam
MAVERICK
ZAVALLA
FRIO
Pearsall
ATASCOSA
Imogene
KARNES
Burnell
Cabeza Creek
Pettus
Wilcox
Hondo Creek
Weiss
Caesar
Plummer
Clayburn
Dukes
Tuleta
GOLIAD
Whitsett
Crowther
Jacob
Carrizo
DIMMIT
Catfish
Oakville
Voss
Foley
Pagan

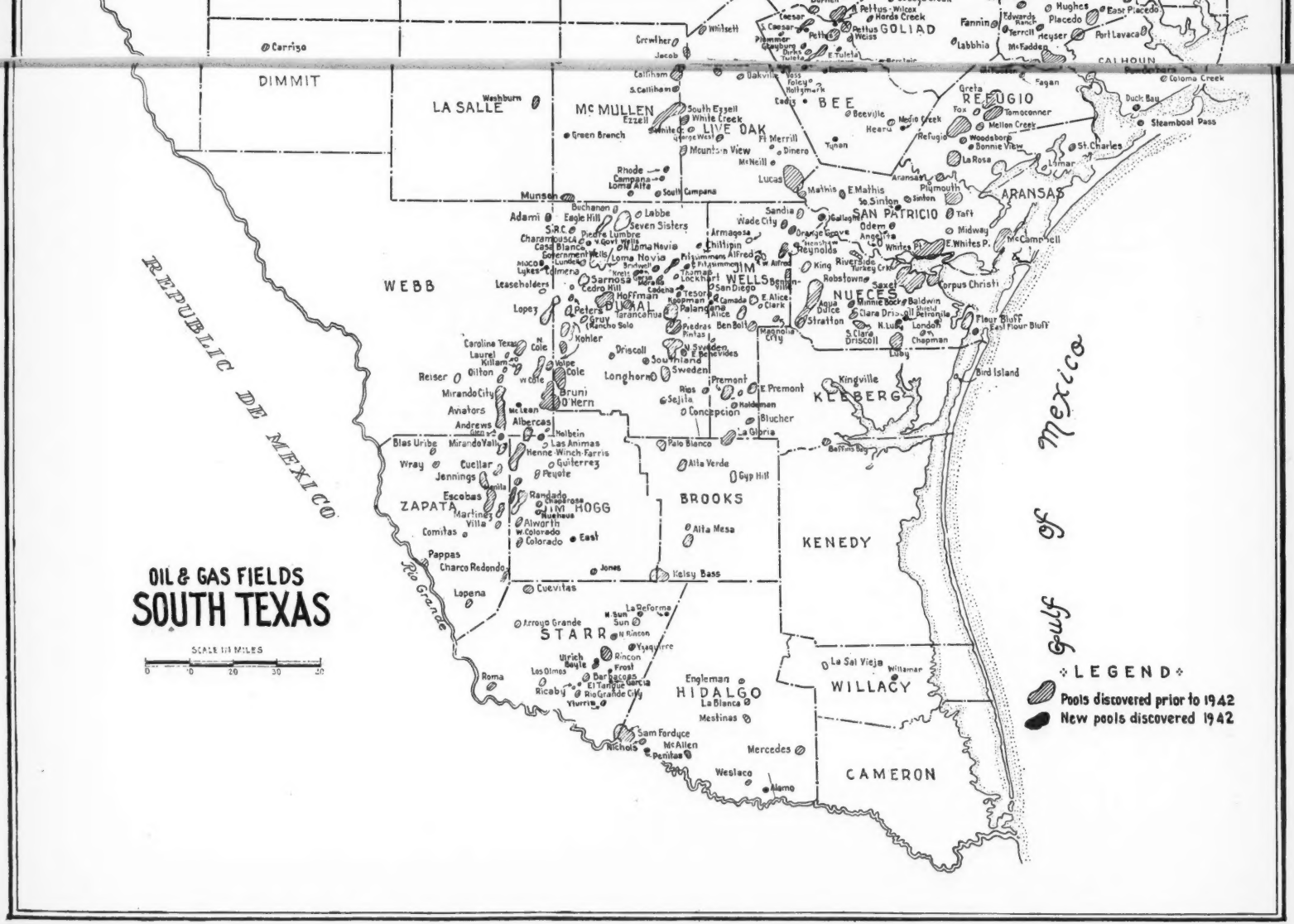

OIL & GAS FIELDS
SOUTH TEXAS
SCALE IN MILES
0 10 20 30 40
REPUBLIC DE MEXICO
Gulf of Mexico
Rio Grande
DIMMIT
LA SALLE
McMULLEN
LIVE OAK
BEE
REFUGIO
ARANSAS
SAN PATRICIO
WEBB
DUVAL
JIM WELLS
NUECES
ZAPATA
JIM HOGG
BROOKS
KENEDY
KLEBERG
STARR
HIDALGO
WILLACY
CAMERON
GOLIAD
CALHOUN
Carrizo
Washburn
Munson
Lopez
Hebbronville
Realitos
Premont
Kingsville
Raymondville
Harlingen
Brownsville
Mission
McAllen
Weslaco
Alamo
Roma
Rio Grande City
Falfurrias
Alice
Corpus Christi
Aransas Pass
Port Lavaca
Refugio
Goliad
Beeville
Pettus
Karnes City
Kenedy
Sinton
Taft
Gregory
Portland
Ingleside
Bishop
Driscoll
Banquete
Agua Dulce
Stratton
Orange Grove
Falfurrias
Encino
Ricardo
Kingsville
Riviera
Sarita
Raymondville
Port Isabel
South Padre Island
LEGEND
Pools discovered prior to 1942
New pools discovered 1942

FIG. 1

TABLE I

FIELDS DISCOVERED IN 1942

Field	*County*	*Type*	*Discovery Well*	*Survey*	*Depth of Producing Sand (Feet)*	*Producing Formation*	*Initial Production (Barrels Per Day)*	*Diameter of Chokes (Inches)*	*Date of Completion (Month-Day-Year)*
Alamo	Hidalgo	Gas	McCollum Oil Co., Sweeney Estate 1	A. del Gato	5,500 & 5,950	Frio	203 Dist.	3/16	4-10-42
Berclair	Bee	Gas	Magnolia Petroleum Co., E. H. Buckner 1	Thos. Simmons, Sec. 6	10,370	Wilcox	20 Dist.	9/64	10-16-42
Cadena	Duval	Oil	Taylor Refg. Co., Cadena 1	Survey 306	5,265	Pettus	64	Jetting	9-18-42
Cadiz	Bee	Gas	I. K. Howeth, Homer Harris 1	Rivas Grant	3,730	Jackson	15	½	7-10-42
Cistern	Fayette	Gas	Continental Oil Co., Fannie Gahitzsen 1	J. T. Whiteside	2,800	Wilcox	1,254 MCF	½	6-12-42
Collier	Jackson	Oil	The Texas Company, O. D. Collier 2	James Kerr, A-39	2,435	Oakville	202	11/64	11-16-42
East	Jim Hogg	Oil	Sun Oil Company, T. T. East D-1	S. D. de Arriba	4,740	Pettus	8.25	3/16	10-23-42
Frost	Starr	Oil	Sun Oil Company, Frost Natl. Bank A-2	Porcion 96	4,180	Frio-Vicksburg	32	Pump	6- 5-42
Garcia	Starr	Oil	Sun Oil Co., Garcia Ld. & Livestk. Co., A-1	Porcion 97	3,750	Frio-Vicksburg	130	9/64	3-13-42
Garza	Duval	Oil	Highland Oil & Newman Bros., Garza 1	Survey 524	3,000	Jackson	25	Pump	1- 9-42
Green Branch	McMullen	Gas	Quintana Pet. Corp., Washburn C-1	B. S. & F. No. 25	5,720	Wilcox	Water well		7- 3-42
Harmon	Jackson	Oil	Gulfboard Oil Corp. & Houston Dr., Harmon 1	A. Kountze 23	5,365	Oligocene	105	5/32	5- 8-42
Imogene	Atascosa	Oil	Humble Oil & Refg. Co., M. L. Thompson 1	McCrea 1293	7,570	Edwards Lime	33	Pump	11-27-42
Koopman	Jim Wells	Oil	Henshaw Bros., John Koopman 1	Sec. 21 Canada Rch.	4,150	Frio	210	3/16	3-20-42
Lykes	Webb	Oil	Magnolia Pet. Company, D. C. R. 1	Zapata School Lands	1,950	Jackson	16	Pump	6-26-42
Mayo	Jackson	Oil	Stewart Boyle & Jno. Mayo, A. C. Rodesney 1	J. Rambo A-357	5,408	Oligocene	115	½	1-16-42
McLean	Webb	Oil	O. W. Killam, Marrs McLean 1	Survey 610	3,243	Yegua	144	½	1-23-42
Medio Creek	Bee	Gas	Shield Oil Company, Ira Heard 1	Garrett Roach A-59	4,855	Frio-Vicksburg			3-13-42
Mustang Creek	Jackson	Oil	Guy I. Warren, O. W. Freemen 1	Wm. Menefee A-53	6,640	Frio	110	9/64	11-27-42
Nordheim	DeWitt	Gas	Tide Water Assoc. Oil Co., E. G. Gips 1	W. A. Moore	7,027	Wilcox	37	3/32	9-11-42
North Pettus-Wilcox	Bee	Gas	Union Producing Co., Geo. Ray 58	R. C. Ballard A-107	6,943	Wilcox	38	9/32	9-25-42
Penitas	Hidalgo	Gas	Arkansas Fuel Oil Co., J. W. Heard 1	Lot 235-A. E. Chavez Grt	6,020	Vicksburg	21.8	5/32	2-27-42
Poth	Wilson	Oil	Holland Oil Company, Chas. Boysen 1	Antonio Flores 13	4,082	Wilcox	28	Pump	6-26-42
Provident City	Lavaca	Gas	Shell Oil Co., F. W. Neuhaus 1	J. D. Ragsdale 39	8,750	Wilcox	90	½	1-30-42
South Caesar	Bee	Oil	Tom Slick, Jr., Grissom 1	P. B. McEarly	6,550	Wilcox	127	½	2-13-42
South Sinton	San Patricio	Gas	Tide Water Assoc., S. A. Loan & Trust Co. 1	M. McAuley	6,073	Frio	4,000 MCF	½	1- 1-42
Stewart	Jackson	Oil	Stewart Boyle, Rose & Sample 1	Geo. Sutherland A-75	5,944	Oligocene	149	½	7-31-42
Tynan	Bee	Oil	Stanolind Oil & Gas Co., Ludvika Ulke 1	H. H. Williams Sur. A-403	4,012	Frio-Vicksburg	28	5/32	1- 8-43
Ulrich	Starr	Oil	Fidelity Oil Co., Sugarland Industries 1	Porcion 91	3,970	Frio	77	½	8- 7-42
West Mauritz	Jackson	Oil	John B. Coffee, Mauritz Bros. 1	Survey No. 21	5,470	Oligocene	85	½	5-22-42
Yorktown	DeWitt	Gas	Adams Oil & Gas Company, E. Berck 1	Jas. Kimberling	7,192	Wilcox	144	½	4-10-42

pipeline allowables and some were closed during the greater part of the year. In these areas, proved and offset locations were not drilled.

Drilling costs were increased by the scarcity of materials and the resort to older men in the unskilled drilling crews. These conditions tended to restrict both wildcat and normal field operations. Independent operators and oil producers who could finance development under normal allowables, with commitments to banks out of production, were forced to retire from speculative ventures. Many wildcatters and promoters were drawn into more lucrative war industry.

EDWARDS PLATEAU

The developments in the Edwards Plateau were disappointing. Very little drilling was done. R. F. Schoolfield's E. E. Bolt No. 2, in the Jas. Dufner Survey, was completed in the Ellenberger as a small gas well, in July, 1942, at the total depth of 1,842 feet. Although the name Bolt was given this discovery, it is considered to be in the old Junction field.

CRETACEOUS—FAULT LINE

In the older Fault Line trend there was very little development. However, new interest was given the deeper Edwards play with the discovery of the Imogene field in Atascosa County, where the Humble Oil and Refining Company completed M. L. Thompson No. 1 as a small pumper in the top of the Edwards limestone at 7,570–7,572 feet. This discovery is important since it is the deepest Edwards production to the present time and revives interest in a fault system and trend located considerably downdip from the older producing fault structures of the Lower Cretaceous.

The only other discovery in this trend was Weigand Bros.' T. J. Gilliam No. 1-A in the townsite of Pearsall. This well produced some oil from a crevice in the Taylor formation at 4,865–4,870 before it was temporarily abandoned in June.

WILCOX TREND

The Wilcox trend received considerable attention during the past year with the result that nine new fields representing 29 per cent of the total number discovered are accredited to this trend. Of this number, seven produce gas and condensate and two are producing oil. One of the most important features of the Wilcox is the great depth range from which production may be expected. This depth varies from 2,800 feet to 8,750 feet.

The South Caesar field of Bee County was the outstanding discovery in the Wilcox of South Texas. There are thirteen oil wells with accumulation controlled by strike faulting to the northwest.

The Poth field of Wilson County was discovered in June by the Holland Oil Company's Chas. Boysen No. 1, which was completed, pumping an estimated 30 barrels per day. Accumulation is controlled by northeast-southwest faulting.

Of the seven gas and condensate Wilcox fields, the Yorktown field appears to offer greater possibilities both in size and character of production.

YEGUA-JACKSON TREND

Wildcatting in the Yegua-Jackson trend decreased considerably, only six fields being discovered, each of which either is a one-well field or production does not warrant further development.

The McLean field of Webb County was discovered by perforating a Yegua sand at 3,243 feet, although that was not the original objective. Five producing oil wells were completed with an equal number of failures.

The Cadena field of Duval County, discovered by geophysics and subsurface geology, has three producing oil wells in the Pettus sand.

Cadiz, discovered by I. K. Howeth's Homer Harris No. 1, was completed as a gas-and-condensate well from a sand in the McElroy member of the Jackson formation. The discovery should be credited to subsurface geology.

The East field, Jim Hogg County, was discovered by a combination of geophysics and core-drill information.

The Garza field, in Duval County, should be described as an extension to the older Kreis field.

The Lykes field of Webb County represents a sand lens of the Mirando group of lower Jackson age. The field is on the south flank of the large Moca structure.

FRIO-VICKSBURG TREND

Development along the Frio-Vicksburg trend was steady throughout the year, with the new discoveries distributed from Jackson County to Starr County. There were 14 new discoveries in this trend, representing 45 per cent of the total discoveries. Of this number, 10 were oil and four were gas fields.

Jackson County was by far the most active county for wildcatting during the past year, with the result that five oil fields were found. The number of producers in each field ranges from 2 to 19. Several of the new discoveries may be extended considerably.

The Mayo field was the most important discovery in the entire trend. At the beginning of 1943 there were 19 producers in the field. Production comes from the 5,400-foot Frio sand locally known as the "Rodesney sand." Two other sands offer possibilities for production: the 4,980-foot *Marginulina* sand and the 5,500-foot Frio sand. Accumulation is largely due to sand lensing on a large structural feature. The Harmon field is on the same general structural feature and, with its 10 wells, should be considered a part of Mayo, since the two fields have joined. Sand development and general producing conditions are very similar.

The Mustang Creek, Stewart, and West Mauritz fields are still in the early stages of development with two, six, and five wells, respectively.

In Starr County, the Garcia field was discovered with the aid of geophysics. At present, there are four producers.

The discovery of gas in the Penitas field, in Hidalgo County, is believed to be the deepest commercial production in the Vicksburg in South Texas in that it is several hundred feet below the *Textularia warreni* which marks the top of definite Vicksburg.

The completion of Stanolind Oil and Gas Company's Ludvina Ulke No. 1, the discovery well of the Tynan field in Bee County, as a small oil producer, represents the first successful effort to extend the producing sands of the Frio-Vicksburg northeast from Jim Wells County.

The Koopman field, in Jim Wells County, contains two wells with production in two sands at 4,120 and 4,690 feet. Sand conditions are poor and erratic.

The Ulrich field, in Starr County, although listed as a new discovery, should be considered an extension to the Boyle field. One oil well and five dry holes were drilled in 1942.

The remainder of the new discoveries in this trend are all one-well fields. The gas fields will probably receive considerable development when general marketing and economic conditions are better and the demand for gas greater.

UPPER OLIGOCENE AND LOWER MIOCENE

Along this highly prolific trend, on which are the West Ranch, La Rosa, Taft, Minnie Bock, Placedo, Coletto Creek, Victoria, and Cordele fields, only one field was discovered. The Texas Company proved a new producing area in Jackson County with O. P. Collier No. 2, and named it the Collier field. Production comes from the Oakville sand at 2,435 feet. This discovery is similar in many respects to the Cordele field on the northeast. Geophysics and subsurface geology are credited with its discovery.

NEW SANDS IN OLDER FIELDS

Closer study and application of electrical well surveys and deeper drilling resulted in the discovery of 22 new producing sands in 16 fields. The Cretaceous, Wilcox, Yegua, and Jackson formations were each credited with one new sand. Three new sands were proved productive in the Frio-Vicksburg underlying old fields. The greatest number of sands were found in the Frio and *Marginulina*-Frio, a total of fifteen, in fields already established.

GAS-RECYCLING OPERATIONS

Thirty-two gas-distillate wells were completed. With the exception of those defining new fields, the remainder were drilled to supply raw gas to recycling plants operating in older fields. With the increase in demand for condensate to meet the war emergency, most of the plants operated at full capacity.

The contemplated construction of new plants in several fields reached little more than the blue-print stage. Operators in the Agua Dulce-Stratton fields redesigned the old equipment to recover butanes and propane. It is believed that with the completion of present plant alterations, no new construction will be attempted.

RESERVES

The discovery of new sands and extensions to older fields added more reserves than the combined estimated recovery from the 31 new fields discovered. Espe-

cially is this true of the Seeligson field in Jim Wells County and the Odem field in San Patricio County. Present development and prospects in the newly discovered fields do not indicate that any will be of major importance.

PRODUCTION

In 1942 approximately 72,200,000 barrels of oil were produced in South Texas. During the 3 years prior to 1942, the average annual production was approximately 81,000,000 barrels. This represents a decrease of slightly more than 11 per cent.

This decrease is believed to reflect war conditions which resulted in lower allowables throughout South Texas, due to lack of marketing and transportation facilities.

It is interesting to note that Jackson County showed a considerable increase in production of about 3,600,000 barrels over 1941. This county produced 9,913,571 barrels in 1942, compared with 6,279,515 barrels in 1941 and 3,185,741 barrels in 1940.

With present proposed pipeline outlets completed, it is believed that production in South Texas will reach a figure comparable with past years.

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DEVELOPMENTS IN WEST TEXAS AND SOUTHEASTERN NEW MEXICO IN 1942[1]

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ABSTRACT

The total number of wells drilled in West Texas during 1942, including those drilled deeper and recompleted, was 1,320 which represents a decline of 44 per cent from the drilling activity of the preceding year, and is the lowest number of wells completed in this area in the last 5 years. The most active field as in 1941 was the Slaughter field which had 418 completions. The number of wildcats completed was 134 which is only one less than in 1941. Thirty-three of these 134 wildcats were completed as producers or a discovery success of 24.6 per cent. These 33 producers resulted in the opening up of 17 new areas of production, 10 extensions of more than one mile from known areas, and the finding of additional producing levels in 6 fields. A new dolomite producing zone in the lower Leonard was found in Andrews County, and a producing sand in the Leonard was found in the Big Lake field, Reagan County. In addition, the first Cambrian sand production for the area was developed from a sand of that age in northern Pecos County. Production from the Tubb zone of the Leonard was developed in Ward, Andrews, and Gaines counties. A new area of Holt zone production of the basal San Andres was opened in southern Gaines County.

Pre-Permian drilling and exploration was the highest in the history of the Permian basin, 126 wells being completed in 1942. Of this total, 51 were drilled in the Abell pool, the most active field, 7 of which were dry and abandoned. Eighty-nine pre-Permian wells were completed as producers, of which 10 were dry in the pre-Permian but were plugged back to the Permian to become producers. Of the 30 pre-Permian wildcats drilled, 6 were completed as producers, giving a discovery rate of 20 per cent.

There were 339 wells drilled in southeastern New Mexico last year, a decline of only 8.7 per cent under 1941. Of this number 35 were wildcats which is 4 less than the number of wildcats drilled in 1941. Twenty-three wildcats were drilled in Eddy County, the others being in Lea, Chaves, Roosevelt, and De Baca counties. Six wildcats resulted in producers which is a discovery success of 17.1 per cent. These six producers accounted for three new areas of production and three extensions of known areas. The wildcat discoveries and extensions were all from known Permian producing zones being from the Yates, Queen, Grayburg, and San Andres formations.

Geophysical activity in both West Texas and southeastern New Mexico was greater in 1942 than during the previous year. Eighty-six crews of all types were working in the area at some time during the year as compared with 69 crews in 1941.

INTRODUCTION

The total number of wells drilled in West Texas in 1942 was the least number which has been drilled in any year for the past 5 years, and the same was true for southeastern New Mexico. Of the 1,320 wells drilled in West Texas, 1,186 were field wells and 134 were wildcats. The number of field producers was 1,107, including 1,052 new oil wells, 45 old oil wells drilled deeper and recompleted, and 10 gas wells. There were 69 dry holes drilled in proved fields, and 10 old-field wells drilled deeper and abandoned. Of the 134 wildcats drilled, 32 were oil wells, one a gas well, and 101 were dry holes.

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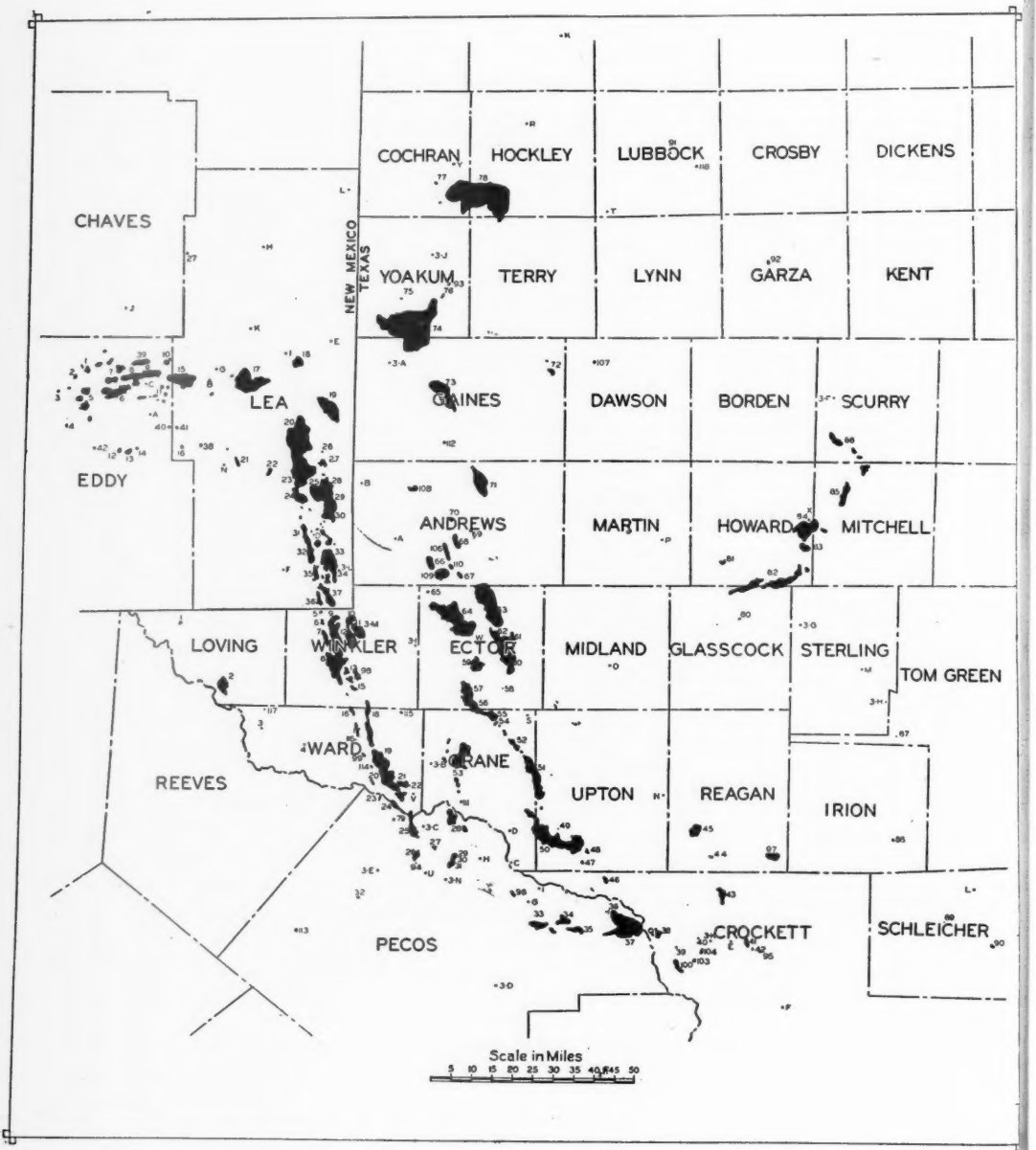

COCHRAN
HOCKLEY
LUBBOCK
CROSBY
DICKENS
CHAVES
NEW MEXICO
TEXAS
YOAKUM
TERRY
LYNN
GARZA
KENT
LEA
GAINES
DAWSON
BORDEN
SCURRY
EDDY
ANDREWS
MARTIN
HOWARD
MITCHELL
LOVING
WINKLER
ECTOR
MIDLAND
GLASSCOCK
STERLING
TOM GREEN
WARD
CRANE
REEVES
UPTON
REAGAN
IRION
PECOS
CROCKETT
SCHLEICHER
Scale in Miles
5 10 15 20 25 30 35 40 45 50

FIG. 1

West Texas Fields

1. Mason
2. Wheat
3. Monroe
4. Hayes
5. Eaves
6. Leck
7. Henderson
8. Hendrick
9. Scarborough
10. Keystone (Colby Sand)
11. Keystone Lime
12. Kermit
13. Emperor Deep
14. Emperor
15. Halley
16. Magnolia
    Sealy
17. Magnolia
    Sealy South
18. North Ward
19. Estes
20. South Ward
21. Shipley
22. Shipley Silurian
23. Netterville
24. Payton
25. Pecos Valley
    High Gravity
26. Pecos Valley
    Low Gravity
27. Lehn
28. Abell
29. Masterson
30. Apco-Warner
31. Fromme
32. Richards
33. Taylor-Link
34. Walker
35. White and Baker
36. Toborg
37. Yates
38. Noelke
39. Olson
40. Live Oak
41. Todd Deep
42. Wyatt
43. World
44. Grayson
45. Big Lake
46. Crockett
47. Webb-Ray
48. Hurdle
49. Herrington
50. McCamey
51. McElroy
52. Dunes
53. Sand Hills Permian and Sand Hills Ordovician
54. Ella Waddell
55. Waddell
56. Jordan
57. Penwell
58. Douro
59. Harper
60. South Cowden
61. Foster
62. Johnson
63. North Cowden and North Cowden Deep
64. Goldsmith
65. North Goldsmith
66. West Andrews
67. Emma
68. Fuhrman
69. Parker
70. Deep Rock
71. Means
72. Cedar Lake
73. Seminole
74. Wasson
    Wasson Deep
    Wasson 72
75. West
76. Waples Platter
77. Dean
78. Slaughter
79. Grassroots
80. Carter
81. Moore
82. Howard-Glasscock
83. Snyder
84. Iatan-East Howard
85. Westbrook
86. Sharon Ridge
87. Funk
88. Irion
89. Opp
90. Page
91. Lubbock
92. Garza
93. Ownby
94. Heiner
95. Bean
96. Wentz
97. Barnhart
98. Weiner
99. Spencer
100. Clara Couch
101. Anthony
102. Dobbs
103. Simpson
104. Hoover
105. Shearer
106. Fuhrman West
107. Welch
*108. Fullerton
*109. Embar and
    Embar Permian
*110. Mascho
*111. McKee
*112. Robertson
*113. Chancellor
*114. Byrd
*115. Monahans and Monahans Permian
*116. Pyote
*117. Pruitt
*118. Stinnett
*119. Blackwell
*120. Dodson

* 1942 discovery.

New Mexico Fields

1. High Lonesome
2. Red Lake
3. Dayton
4. McMillan
5. Artesia
6. Loco Hills
7. Leonard
8. Grayburg
9. Jackson
10. Robinson
11. Shugart
12. Getty
13. Barber
14. PCA
15. Maljamar
16. Halfway
17. Vacuum
18. South Lovington
19. Hobbs
20. Monument
21. Lynch
22. West Eunice
23. Eunice
24. South Eunice
25. Arrowhead
26. Skaggs
27. Caprock
28. Hardy
29. Penrose
30. Skelly
31. Lynn
32. Cooper
33. Mattix
34. Langlie
35. Jal
36. Eaves
37. Rhodes
38. Salt Lake
39. Square Lake
40. West Lusk
41. East Lusk
*42. Russell

* 1942 discovery.

Important Wildcats

West Texas

A. Atlantic Refining Co. Texas Univ. No. 1-A
B. Humble Oil and Refining Co. Simms No. 1
C. Skelly Oil Co. Richardson No. 1
D. Gulf Oil Corp. Dawson No. 1
E. Amerada Petroleum Corp. Todd No. 1-C
F. Moncrief and Helmerich & Payne's Couch No. 1
G. M. D. Bryant and McCandless *et al.* McDonald No. 1
H. Gulf Oil Corp. Shearer No. 1
I. Magnolia Petroleum Co. Price No. 1
J. Humble Oil and Refining Co. Matador No. 2
K. Stanolind Oil and Gas Co. Hopping No. 1
L. Livermore and Wahlenmaier's Thompson No. 1
M. Gulf Oil Corp. Foster No. 1-C
N. Plymouth Oil Co. Alford No. 1
O. Broderick and Calvert's Bryant No. 1
P. Magnolia Petroleum Co. Powell No. 1
Q. Moore Bros. and Olson Drlg. Co. Halff No. 2-C
R. Stanolind Oil and Gas Co. Williams No. 1
S. The Texas Co. Fraser-T.X.L. No. 1
T. George P. Livermore's Moxley No. 1
U. Anderson-Prichard Oil Co. Ogilvie No. 1
*V. J. D. O'Quinn's Nichols No. 1
*W. Oil Well Drlg. Co. J. L. Johnson No. 1
*X. Ray Oil Co. W. R. Read No. 1
*Y. Sunray Oil Co. Della Slaughter Wright No. 1

* Producers.

New Mexico

*A. Culbertson and Irwin, Inc., *et al.* Vandergriff No. 1
*B. Phillips Petroleum Co. Philmex No. 1
*C. P. B. English's Turner No. 1
*D. Western Gas Co. Combest No. 1-X
E. Richmond Drlg. Co. State No. 1
F. Prexy Wilson's Saunders No. 1
G. Richmond Drlg. Co. Shell-State No. 1-B
H. American Drlg. Co. Tide Water-State No. 1
I. Penrose's State No. 1
J. Steinberger's Headley No. 1
K. George P. Livermore's Maxwell-State No. 1
L. Ohio Oil Co. State-McCormick No. 1
M. South Basin's Good No. 1
N. Felmont Corp. State No. 1

* Producers.

Important Drilling Wells in West Texas and New Mexico

3-A. Shell Oil Co. Leaverton No. 1
3-B. Gulf Oil Corp. Estes No. 1
3-C. Magnolia Petroleum Co. Eaton No. 1–29
3-D. Phillips Petroleum Co. Price No. 1
3-E. Magnolia Petroleum Co. Robertson No. 1
3-F. Humble Oil and Refining Co. Newman No. 1
3-G. Col-Tex's Reed No. 1
3-H. Ohio Oil Co. Clark No. 1
3-I. Shell Oil Co. Blue No. 1
3-J. Barnsdall Oil Co. Heath No. 1
3-K. Moore Brothers' Todd No. 1
3-L. R. Olsen *et al.* Langlie No. 1
3-M. A. G. Carter's Walton No. 2-C
3-N. Anderson-Prichard Oil Co. Masterson No. 1

WEST TEXAS OPERATIONS 1937–1942

	1937	*1938*	*1939*	*1940*	*1941*	*1942*
Total wells drilled	2,604	2,018	1,854	1,866	2,325	1,320
Number of field producers	2,352	1,716	1,640	1,747	2,190	1,107
Number of wildcats	166	192	114	119	135	134
Per cent wildcat successes	22.9	24.0	25.4	39.4	20.0	24.6
Pipe-line runs (millions of barrels)	75.52	74.37	81.91	112.91	117.57	81.03

In southeastern New Mexico, of the 339 wells drilled, 299 were field wells which consisted of 248 producers and 51 dry holes in proved fields. Six of the 35 wildcats resulted in oil wells, and 29 were dry holes.

NEW MEXICO OPERATIONS 1937–1942

	1937	*1938*	*1939*	*1940*	*1941*	*1942*
Total wells drilled	666	559	648	542	371	339
Number of field producers	617	481	563	468	332	246
Number of wildcats	43	66	62	22	39	35
Per cent of wildcat successes	13.9	37.9	45.1	13.5	10.0	17.1
Pipe-line runs (millions of barrels)	37.95	35.29	36.97	35.48	39.34	31.93

The decrease in the number of field wells drilled was due primarily to the depressed marketing conditions in this area, namely, the low allowables, pipe-line proration, and low crude price. Three other contributing factors of less importance were: (1) the tendency of operators to conserve material; (2) the lack of many large undeveloped proved tracts; (3) the 40-acre spacing regulation. The latter factor was of no consequence in New Mexico and very little in West Texas where in many fields by a voluntary adoption the 40-acre spacing program was already in effect. The fact that the number of wildcats drilled did not decline, in contrast to the field wells, was due to three factors: (1) the continued drilling to the pre-Permian; (2) the search over a much greater area for production from the older Permian, principally the lower Leonard; (3) the very important reason that the number of first-class subsurface prospects in West Texas and New Mexico was (and still is) sufficient to warrant the drilling of deeper wildcats in order to establish reserves. The last factor is borne out by the continued high discovery rate in the area.

There were seventeen new areas opened in West Texas for future development. These were: (1) Andrews County, Fullerton, Embar and Mascho pools; (2) Coke County, Blackwell pool; (3) Concho County, Dodson pool; (4) Crane County, McKee pool; (5) Ector County, Oil Well Drilling Company's Johnson No. 1 (unnamed); (6) Gaines County, Robertson pool; (7) Lubbock County, Stinnett pool; (8) Pecos County, Chancellor pool; (9) Sutton County, S. B. Roberts' Allison No. 1 gas well (unnamed); (10) Ward County, Byrd, Monahans, Pruitt, and Pyote pools, O'Quinn's Nichols No. 1 (placed in Shipley field); (11) Howard County, Ray Oil Company's Read No. 1 (placed in Iatan-East Howard field). At the close of the year an important new area of Tubb zone production was being opened in northern Gaines County, but the well had not been officially gauged. In addition, new pay levels were found in six fields: (1) Andrews

County, Embar Permian (Tubb production); (2) Crane County, South Sand Hills (Ordovician) (Tubb production); (3) Pecos County, Chancellor pool (Castile-Delaware contact production) and Wentz pool (Cambrian sand production); (4) Reagan County, Big Lake pool (Leonard sand production); (5) Ward County, Monahans Permian (Tubb production).

The largest additions to the crude reserves of West Texas were, without doubt, the opening of the Embar and Fullerton pools in Andrews County, and the Monahans pool in Ward County. It is perhaps too early to judge the Robertson pool in southern Gaines County on the basis of its one well, but the other 11 new pools (omitting the gas well discovery in Sutton County) are limited in areal extent and, judged from the small initial production of the discovery wells, the recoveries per acre will not be large. The Embar and Monahans pools are outstanding in that both of these structures have shown good production from both the Ellenburger (Ordovician) and the Tubb zone (Permian).

The price schedule for crude oil which was posted in May, 1941, continued without change throughout 1942. This schedule called for a price of $0.72 per barrel for oil of 20° gravity or less with an increase of 2¢ per degree of gravity up to 40° gravity with $1.12 per barrel being paid for oil of 40° gravity or better.

During the year the main trunk-line capacity of West Texas and southeastern New Mexico was reduced from 440,000 barrels per day to 401,000 barrels per day, and 112,969,839 barrels of oil were moved out of the area by pipe-line compared with the 156,910,000 barrels removed during 1941. Not only did the pipeline runs decrease, but there was an unequal distribution of production among fields due to the inability of certain crude purchasers to dispose of West Texas sour crude.

Geological developments during 1942 included the publication of approximately 20 papers on the stratigraphy, structure, and paleontology of the area. There were four comprehensive papers which covered the Permian stratigraphy and paleogeography of West Texas and adjacent areas, the most complete of which was Phillip B. King's "Permian of West Texas and Southeastern New Mexico."[4] The other three were by John M. Hills,[5] Robert I. Roth,[6] and Robert E. King, *et al.*[7]

There were papers dealing with the stratigraphy of the Simpson[8] group, the

[4] Philip B. King, "Permian of West Texas and Southeastern New Mexico," *Bull. Amer. Assoc Petrol. Geol.*, Vol. 26, No. 4 (April, 1942), pp. 535–763.

[5] John M. Hills, "Rhythm of Permian Seas—A Paleogeographic Study," *ibid.*, Vol. 26, No. 2 (February, 1942), pp. 217–75.

[6] Robert I. Roth, "West Texas Barred Basin," *Bull. Geol. Soc. America*, Vol. 53, No. 11 (November, 1942), pp. 1659–74.

[7] West Texas Geological Society Committee, Robert E. King, Chairman, "Résumé of Geology of the South Permian Basin, Texas and New Mexico," *ibid.*, Vol. 53, No. 4 (April, 1942), pp. 539–60.

[8] Taylor Cole, C. D. Cordry, and H. A. Hemphill, "McKee and Waddell Sands, Simpson Group, West Texas," *Bull. Amer. Assoc. Petrol. Geol.*, Vol. 26, No. 2 (February, 1942), pp. 279–82.

Seven Rivers[9] formation, and the Salado[10] formation. In the last paper the La Huerta siltstone member and the Fletcher anhydrite member of the Salado are described and defined. Paleontological papers included one on "Ordovician Conodonts of the Marathon Basin, Texas,"[11] and one on lower Pennsylvanian conodonts of the same area.[12] Permian algae from the Guadalupe Mountains, New Mexico, were described by J. Harlan Johnson[13] and Silurian[14] and Ordovician[15] graptolites were described from deep wells in central Crane County. New genera of Pennsylvanian fusulinids[16] were described and some ostracods from the upper Permian.[17] The results of insoluble-residue work on the Ellenburger of the subsurface were given in a paper by Taylor Cole.[18] In addition to the regular development paper of the year by a committee of the West Texas Geological Society,[19] there was a paper on the Payton pool[20] and a geological note on the Barnhart field.[21] One paper dealt with the pre-Cretaceous topography of the Edwards Plateau area.[22]

ACKNOWLEDGMENTS

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[9] Robert L. Bates, "Lateral Gradation in the Seven Rivers Formation, Rocky Arroyo, Eddy County, New Mexico," *ibid.*, Vol. 26, No. 1 (January, 1942), pp. 80–100.

[10] Walter B. Lang, "Basal Beds of Salado Formation in Fletcher Potash Core Test near Carlsbad, New Mexico," *ibid.*, pp. 63–80.

[11] Roy W. Graves, Jr., and Samuel Ellison, "Ordovician Conodonts of the Marathon Basin, Texas," *Bull. Univ. Missouri School of Mines and Metallurgy*, Vol. 14, No. 2, Tech. Ser. (Rolla, September, 1941), 26 pp.

[12] *Idem*, "Lower Pennsylvanian (Dimple Limestone) Conodonts of the Marathon Region, Texas," *ibid.*, Vol. 14, No. 3 (December, 1941). 21 pp.

[13] J. Harlan Johnson, "Permian Lime-Secreting Algae from the Guadalupe Mountains, New Mexico," *Bull. Geol. Soc. America*, Vol. 53, No. 2 (February, 1942), pp. 195–226.
J. Harlan Johnson and M. E. Dorr, "The Permian Algal Genus *Mizzia*," *Jour. Paleon.*, Vol. 16, No. 1 (January, 1942), pp. 63–67.

[14] Charles E. Decker, "A Silurian Graptolite Zone in Crane County, Texas," *Bull. Amer. Assoc. Petrol. Geol.*, Vol. 26, No. 5 (May, 1942), pp. 857–61.

[15] *Idem*, "Two More Ordovician Well-Core Graptolites, Crane County, Texas," *ibid.*, Vol. 26, No. 11 (November, 1942), pp. 1771–75.

[16] M. L. Thompson, "New Genera of Pennsylvanian Fusulinids," *Amer. Jour. Sci.*, Vol. 240, No. 6 (June, 1942), pp. 403–20.

[17] Irving B. Hamilton, "Ostracodes from the Upper Permian of Texas," *Jour. Paleon.*, Vol. 16, No. 6 (November, 1942), pp. 712–18.

[18] Taylor Cole, "Subsurface Study of Ellenburger Formation in West Texas," *Bull. Amer. Assoc. Petrol. Geol.*, Vol. 26, No. 8, pp. 1398–1409.

[19] West Texas Geological Society Committee, "West Texas and Southeastern New Mexico Development in 1941," *ibid.*, Vol. 26, No. 4 (June, 1942), pp. 1007–39.

[20] Richard E. Gile, "Payton Pool, Pecos and Ward Counties, Texas," *ibid.*, Vol. 26, No. 10 (October, 1942), pp. 1632–46.

[21] Taylor Cole, "Barnhart Field, Reagan County, Texas," *ibid.*, Vol. 26, No. 3 (March, 1942), pp. 387–88.

[22] Eric H. Jager, "Pre-Cretaceous Topography of Western Edwards Plateau, Texas," *ibid.*, pp. 380–86.

DEVELOPMENTS IN PERMIAN OF WEST TEXAS, 1942

As in previous years, exploratory drilling to the Permian was carried on throughout the basin during 1942. The Central Basin platform was still the favored area for wildcatting where 34 wildcats were drilled as Permian tests. Ten new areas of Permian production and eight extensions were found on the platform which is a discovery rate of 50 per cent, or 25 per cent better than the figure of 24.6 per cent for the entire basin. The Delaware basin received six wildcats and the Midland basin received seven during the year. The remaining wildcats were scattered over the North basin, East side, and South basin areas.

NEW PERMIAN PAY ZONES

Two new Permian pay zones were discovered in 1942, both from rocks of the Leonard series. Additional drilling to the lower part of the Permian has partly clarified the correlation of the deeper pay zones being discovered, but opinion differs about their exact ages. The correlations set forth here are those of the writers who take complete responsibility for their interpretations.

The first deep Permian production on the Central Basin platform north of Crane County was opened early in 1942 when the Fullerton Oil Company's H. M. Wilson No. 1 was completed on March 3, 1942. This well, located in Sec. 15, Block A-32, Andrews County, was drilled on a seismograph prospect on a prominent regional anticlinal trend in the northwestern part of the county. The importance of this discovery is not only in the opening of a new Permian pay level but also the opening of a vast area including Ector, Winkler, Andrews, and southern Gaines counties for deeper Permian possibilities.

The discovery well of the Fullerton pool was drilled to the total depth of 8,005 feet to fulfill the contract and plugged back to 7,280 feet for completion. Gas was encountered from 3,119 to 3,130 feet in a sand in the basal part of the Yates or the top of the Seven Rivers. This gas zone has given trouble in subsequent wells, causing blow-outs and the practice now is to set and cement a string of casing either through the sand or just above it. The top 50 feet of the San Andres (Leonard) from 4,415 to 4,465 feet showed some slight porosity and oil stain of non-commercial value. The base of the San Andres and the top of the Clear Fork contact is at 6,090 feet on the basis of correlation and the base of the San Angelo clastics. The top of the Tubb zone was found at 6,680 feet at the base of a 100-foot sandy zone which seems to overlie the Tubb zone nearly everywhere.

The first porosity and oil showings came in at 6,800 feet and a drill-stem test from 6,806 to 7,055 feet yielded 930 feet of oil and gas-cut mud in 35 minutes. The next drill-stem test from 7,107 to 7,222 feet recovered only 330 feet of gas-cut mud and an estimated 10,000 cubic feet of gas in 120 minutes. The main "pay" was found at 7,222 feet, or 542 feet below the top of the Tubb zone. A drill-stem test from 7,222 to 7,324 feet, open 45 minutes, blew air the first 9 minutes, an estimated 30,000 cubic feet of gas for 26 minutes, and flowed an

estimated 30 barrels of oil per hour the last 10 minutes. Four drill-stem tests below 7,324 feet yielded either mud or sulphur water.

Casing was set and cemented at 7,285 feet, and the pay section was treated with a total of 9,500 gallons of acid through perforations. On a Railroad Commission gauge the well flowed 682 barrels of 43° gravity oil in 24 hours through 1-inch tubing choke with a gas-oil ratio of 364:1. At the end of 1942, eleven oil wells had been completed, four wells were drilling, and no dry holes had been drilled.

A second new Permian pay zone was opened on the northeast edge of Big Lake field, Reagan County. The Big Lake Oil Company's University No. 19-C was staked in Sec. 24, Block 9, University Lands, as an 8,500-foot test to the Ellenburger, the established deep producing formation of the field. In drilling, oil showings were noted in broken sands from 4,212 to 4,373 feet, and this section was tested at the total depth of 4,381 feet. On the basis of this test, casing was cemented at 4,195 feet. The well rated an initial potential gauge of 3,423 barrels of 42.2° gravity oil on the basis of a 4-hour flow of 570 barrels through open tubing with a gas-oil ratio of 574.

The broken sand section from which this well is producing is within the Leonard series, but there is a difference of opinion as to whether the sands are in the San Angelo formation or in the upper Clear Fork. The excellent initial performance of the University No. 19-C was offset by the drilling of two dry holes to this 4,300-foot zone; one 1,800 feet to the northwest and one 662 feet to the west. Both of these wells found tight silty sand in this zone which suggests the oil in the vicinity of the No. 19-C is present in a stratigraphic trap caused by the silting up of these sands in a westerly and southwesterly direction.

NEW AREAS OF ESTABLISHED PAY ZONES IN PERMIAN

1. *Upper Delaware Mountain, Yates sand, and Seven Rivers.*—The Chancellor pool is a new producing area in the southwestern part of the Delaware basin. This area was mentioned in the 1941 development report, but the discovery well, the Pure Oil Company's G. C. Frazier No. 1-A in Sec. 31, Block 49, T. 10, Texas and Pacific Railway Company Survey, Pecos County, was not completed until March 24, 1942, when it gauged 66 barrels of 38° gravity oil per day, flowing through a 1-inch choke on tubing. The well is producing from the upper part of the Delaware Mountain sand from 5,082 to 5,096 feet. During the year two offsets to the discovery well were drilled. The south offset was dry in the sand and was plugged and abandoned. The west offset, the Pure Oil Company's Le Gros No. 1, found "pay" at the contact of the Castile formation and the underlying Delaware Mountain formation above the regular sand "pay" at the total depth of 5,072 feet. The well flowed 688 barrels of 38° gravity oil per day through ½-inch tubing choke with a gas-oil ratio of 1360:1.

Another new producing area of minor importance in the Delaware basin was opened in 1942 by F. A. Hyer's Pruitt No. 1, Sec. 23, Block 1, W. & N. W.

Survey in western Ward County. The well found the Delaware Mountain sand at 4,847 feet and drilled to 4,869 feet where it flowed 15 barrels of 32° gravity oil plus 10 barrels of water per day with a gas-oil ratio of 800:1. No other wells were drilled in the area during the year, and it is not possible to state what type of trap is present.

The Byrd and Pyote pools in Ward County were discoveries in the Yates formation and are located on the trend of reef pools on the western edge of the Central Basin platform. The Byrd pool was discovered by the Stanolind Oil and Gas Company's H. L. Byrd No. 1, Sec. 34, Block 34, H. & T. C. Survey, which was drilled on an anticline mapped on subsurface data. The well was drilled to 2,885 feet and plugged back to 2,679 feet for completion from 2,637 to 2,679 feet in the Yates sand the top of which was at 2,570 feet. On official gauge, after being shot with 105 quarts of nitroglycerine, it flowed 29 barrels of 30° gravity oil per day with a gas-oil ratio of 287:1 through $\frac{1}{8}$-inch tubing choke. At the end of the year, the field had 4 producers and no dry holes.

The Darby Petroleum Company's University No. 1, Sec. 19, Block 16, University Lands Survey, was drilled on a subsurface prospect a short distance north of the Spencer Reef pool. The well was structurally low, finding the Yates sand at 2,775 feet, about 200 feet lower than on the Spencer structure, but it found porosity and oil stain in dolomite in the Yates formation from 2,825 to 2,847 feet, the total depth, and it opened the Pyote pool. The well made a natural flow of 888 barrels of 19.3° gravity oil per day through tubing with a gas-oil ratio of 61:1. The east offset was a small well, but the north and west offsets were dry holes, indicating a trap due to loss of porosity in the Yates formation updip on the east.

2. *Queen formation.*—The only new area of Queen production found in 1942 was in southern Ward County which was opened by O'Quinn's Nichols No. 1, Sec. 5, Block 5, H. & T. C. Survey. This represents a new area of production, separated from others by dry holes, although it has been placed in the Shipley field by the Railroad Commission of Texas. The well was drilled on the basis of oil showings in the Queen formation in a dry hole 933 feet south, and it pumped 49 barrels of 35° gravity oil per day after a shot in the pay section from 2,410 to 2,442 feet with 103 quarts of nitroglycerine. The total depth is 2,449 feet. There was one well drilling at the end of the year.

There was considerable activity in the Colby sand (Queen) fields of Winkler County, and the Weiner pool was given a one-mile northwest extension by Ralph Lowe's Brown and Altman No. 1, Sec. 24, Block B-5, P. S. L. Survey. This well was drilled to 3,212 feet where sulphur water was encountered, and it was plugged back to 3,187 feet. After the sands and dolomite of the Queen were shot from 3,050 to 3,187 feet with 540 quarts of nitroglycerine, the well flowed 186 barrels of 35° gravity oil per day through 1-inch tubing choke with a gas-oil ratio of 1600:1. At the end of the year, the extension area of the Weiner pool had 7 oil wells and one gas well.

The Walker pool, Pecos County, was extended one mile west when J. D. Lancaster's University No. 2-A, Sec. 26, Block 16, University Lands Survey, was completed, pumping 15 barrels of oil and 30 barrels of water per day. This well is in the regular producing sand of the Walker pool, which is Queen in age. Development during the year resulted in eight oil wells, most of them between the extension and the field. In the same area, the White and Baker pool was extended 1½ miles west by the Cardinal Oil Company's White and Baker No. 1-L, Sec. 90, Block 194, G. C. & S. F. Survey, which flowed 51 barrels of 31° gravity oil per day, with a gas-oil ratio of 700:1, from a sand at 1,902 to 1,932 feet. Five oil wells were drilled in the extension area with no dry holes.

3. *Grayburg formation.*—Wildcatting with the Grayburg formation as the objective continued to decline during 1942 due to the scarcity of undrilled prospects along the east edge of the Central Basin platform where the Grayburg producing fields were discovered. Of the 13 wildcats drilled as Grayburg prospects, only one was located on the platform, and six were located in the Midland basin. The others were scattered through Crockett and Reagan counties.

The only Grayburg test to discover oil was the Sun Oil Company's Shannon Estate No. 1, League 1, Archer County School Land Survey, Crockett County, which was a 1¾-mile north extension to the Olson pool which had one producer. The Shannon Estate No. 1 made a natural gauge of 364 barrels of 19° gravity oil and 91 barrels of water pumping from "pay" at 2,080 to 2,085 feet.

4. *San Andres formation.*—Two new localities of San Andres production and seven extensions to old areas were discovered during the year. Most of this activity was in southern Andrews County where the Mascho pool was discovered, the West Andrews pool was extended three times, and the Fuhrman (West) pool was extended both north and south.

A. *Upper San Andres pay zone.*—Early in 1942, at the time of the discovery of oil in the Ellenburger in the Embar pool, Andrews County, there were many ¼-section leases expiring before the end of the year. Production had been established in the area in 1940 with the discovery of the West Andrews pool which consisted of three small wells producing from the upper part of the San Andres. To protect these short-term leases, operators drilled 25 wells to the upper San Andres pay zone. As a result, 16 small producers were added to the West Andrews pool and one of the other wells made a producer in the Ellenburger. The porosity is poor and limited, in the upper San Andres on this structure, which explains the light wells.

East of the Embar pool, the Mascho Oil Company drilled its Sun-University No. 1 on a trend northwest of the Emma pool, which resulted in the discovery of the Mascho pool. The Mascho Oil Company's Sun-University No. 1, Sec. 27, Block 10, University Lands Survey, pumped 178 barrels of 31.9° gravity oil per day through tubing after the pay section from 4,440 to 4,514 feet was shot with 310 quarts of nitroglycerine. "Pay" is from the San Andres which was topped

at 4,380 feet. The Mascho pool trap is a small anticline or terrace on the northeast flank of the Embar dome. Seven oil wells had been completed in the field at the end of the year, one of which was a 2-mile northwest extension, the Mid-Continent Petroleum Corporation's University-South No. 1, Sec. 16, Block 10, University Lands Survey, pumping 95 barrels of 32° gravity oil per day after the pay section was shot from 4,519 to 4,594 feet with 410 quarts of nitroglycerine.

The Fuhrman (West) pool in the same area of Andrews County was extended 1½ miles south by the Siemoneit Drilling Company's University No. 1, Sec. 10, Block 10, University Lands Survey. On initial gauge, the well pumped 201 barrels of 32° gravity oil per day after the pay section was shot from 4,365 to 4,580 feet with 570 quarts of nitroglycerine. Seven wells were completed during the year between the extension well and the field. The completion of the Seaboard Oil Company's Thornberry No. 1-F extended the Fuhrman (West) pool one mile north. This well flowed 66 barrels of 25° gravity oil per day with a gas-oil ratio of 250:1 after the pay section was shot with 550 quarts of nitroglycerine, and after treatment with 16,000 gallons of acid.

The Oil Well Drilling Company's J. L. Johnson No. 1, Sec. 48, Block 44, T. 1 S., T. & P. Survey, Ector County, opened a new spot of production which has been included in the Goldsmith pool by the Railroad Commission of Texas. The test was drilled on a combination of subsurface and seismic work south of the Goldsmith field. The San Andres was found at 4,200 feet, and dolomite from 4,230 to 4,400 feet showed light porosity and oil stain with no showings from 4,400 to 4,510 feet, the total depth. After being shot from 4,270 to 4,353 feet with 40 quarts of nitroglycerine and treatment with 5,000 gallons of acid, the well flowed 20 barrels of 33° gravity oil per day with a gas-oil ratio of 10,864:1. There was no further development around the well during the year.

B. *Cedar Lake pay zone.*—One wildcat was drilled 2 miles northeast of the Cedar Lake field which was 100 feet lower structurally on the San Andres than wells in the field, and it was abandoned. This was the Magnolia Petroleum Company's Scanlon No. 1, Sec. 113, Block M, E. L. R. R. Survey, Dawson County. It was drilled to 5,085 feet, finding slight porosity from 4,980 to 5,085 feet with no shows.

The Welch pool was discovered in late 1941 by Ray Albaugh's J. J. Handley No. 1, Sec. 26, Block M, E. L. R. R. Survey, Dawson County, but it was not officially gauged until January, 1942, when it pumped 181 barrels of 33° gravity oil and 8 per cent water per day from a pay zone from 4,917 to 4,980 feet. Since this discovery was described in the development report for 1941, it is not included as one for 1942. There was no further drilling in the Welch pool during the year.

C. *Wasson pay zone.*—There were no new discoveries during the year from the Wasson pay zone, and nearly all the drilling to this zone was confined to development around the edges of the Wasson field itself. Development in Secs.

631 and 614, Block D, John H. Gibson Survey, Yoakum County, extended the old part of the field ½ mile north. Drilling continued in the west part of the field and along the southeast flank. The Waples-Platter and Ownby pools each received two producers.

Three miles southwest of the Wasson field, the Amerada Petroleum Corporation's Ruth Hudson No. 1, Sec. 60, Block AX, P. S. L. Survey, Gaines County, attempted to obtain production from a section of porosity and oil stain from 4,952 to 5,036 feet, the total depth. After treatment with 12,000 gallons of acid and shooting of the section with 96 quarts of nitroglycerine, the production was non-commercial and the well was abandoned.

The Shell Oil Company, Inc., drilled Leaverton No. 1 (mentioned later) in Sec. 458, Block G, C. C. S. D. & R. G. N. G. Survey, Gaines County, as a 7,500-foot test. It is 4 miles southwest of the field and 4 miles south of the Amerada's Ruth Hudson No. 1. Porosity and oil stain were found in Wasson pay zone from 4,950 to 5,138 feet, but a drill-stem test showed only sulphur water, and the well was carried deeper.

D. *Slaughter pay zone.*—As in 1941, the Slaughter field in Cochran, Hockley, and Terry counties was the most active area in the region with 418 completions. Much of this development took place on the north and northwest edge of the field where approximately 4,500 proved acres were added to the field. The southeast edge of the field in Terry County was defined by three small wells and two dry holes, all offsetting producers. One mile south of the field, George P. Livermore's Mabee *et al.* No. 1, Sec. 20, Block D-11, C. &. M. Survey, Terry County, was 200 feet lower than wells in the field on the top of the San Andres found at 4,440 (−916) feet. Cores taken from 5,260 to 5,316 feet in the Slaughter pay zone showed sulphur water, and the well was plugged and abandoned at that depth.

Four and one-half miles north of the northwest edge of production, the Sunray Oil Company's Della Slaughter Wright No. 1 was completed as a producer from the Slaughter pay zone, becoming a wildcat extension to the field. The well pumped 238 barrels of 30° gravity oil and 32 barrels of water per day after treatment with 15,000 gallons of acid. Two and one-half miles west of the Sunray well, John Redfern's Wright No. 1, Labor 2, League 95, Mills County School Land Survey, was dry and abandoned at 5,004 feet after finding only fair porosity and light oil stain in the Slaughter zone from 4,810 to 5,004 feet.

Northwest of the Slaughter field in Hockley County, three wildcats were drilled seeking production from the Slaughter pay zone. The test nearest the field, the Tide Water's Commerce Trust Company No. 1, Labor 19, League 31, Baylor County School Land Survey, was drilled to 5,208 feet and found only scattered porosity and oil stain in the Slaughter zone from 5,100 to 5,208 feet. Eight miles northeast of the Tide Water well, Bruce McKague's Goodpasture No. 1, Labor 16, League 17, Wichita County School Land Survey, was 100 feet higher structurally on the San Andres datum but found no porosity in the

Slaughter zone from 4,920 to 5,020 feet. The test was drilled to 5,203 feet, finding porous dolomite with water from 5,110 to 5,203 feet and was abandoned. The Anderson-Prichard Oil Corporation's Elwood Estate No. 1, Sec. 15, Block A, R. M. Thompson Survey, was located 7 miles northwest of the McKague well. It found the Slaughter zone from 4,700 to 4,800 feet non-porous and was drilled through the San Andres into the Yeso-Clear Fork section in which it was abandoned at 6,000 feet.

A Slaughter pay zone test in northwestern Yoakum County, the Rowan Drilling Company's Field No. 1, Sec. 46, Block D, J. H. Gibson Survey, was abandoned when sulphur water was found in that zone from 5,160 to 5,208 feet, the total depth.

5. *Holt pay zone-lower San Andres.*—The discovery of oil from the Holt pay zone in The Texas Company's J. Bay Robertson No. 1, Sec. 25, Block A-21, P. S. L. Survey, southern Gaines County, is important in that it is the first production in this zone north of the North Cowden field, Ector County, where the Holt pay zone first produced. The distance between the areas is 42 miles. The Robertson well was drilled as a deep test on a definite anticline on which shallow San Andres production was discovered in 1936 by the Landreth Production Company's Kirk Brothers No. 1. This producer was subsequently abandoned. The discovery well was drilled to 7,686 feet, finding sulphur water in the Fullerton pay zone on a drill-stem test from 7,545 to 7,620 feet. The Tubb zone which was topped at 7,240 feet was non-porous, and the well was plugged back to 6,505 feet for tests of the upper Clear Fork. These tests showed only sulphur water, and operators then plugged back to 5,952 feet where casing was perforated from 5,910 to 5,950 feet in the Holt pay zone. After treatment with 11,500 gallons of acid, the well flowed 299 barrels of 26.3° gravity oil per day with a gas-oil ratio of 350:1. There were no other tests in the area which has been named the Robertson pool.

A new area of production was opened by the Ray Oil Company's W. R. Read No. 1, Sec. 37, Block 30, T. 1 N., T. & P. Survey, Howard County. Oil was found in the San Angelo section of the lower San Andres from 2,645 to 2,750 feet. On potential gauge, the well pumped 222 barrels of 32° gravity oil per day after being shot with 430 quarts of nitroglycerine. The total depth was 2,884 feet, plugged back to 2,750 feet. Location for the test was made on a subsurface nose extending north from the old Iatan-East Howard field. Although the well is separated from the Iatan-East Howard field by dry holes, it was placed in that field by the Railroad Commission of Texas.

6. *Yeso-Clear Fork plus Wichita.*—Fifteen wildcats were drilled in the north part of the basin, to test the Yeso-Clear Fork, Wichita, and deeper Permian section. The finding of the Lubbock pool in Lubbock County which produces from the Clear Fork gave impetus to this deep exploration as well as the opening of the Fullerton pay zone in Andrews County early in 1942. The latter has already been described as a new pay zone in the Leonard series.

In Lubbock County, 15 miles east and slightly south of the Lubbock pool, the Stanolind Oil and Gas Company's Stinnett No. 1, Labor 18, League 4, Saint Augustine County School Land Survey, opened the Stinnett pool when it was completed as a producer in August. On potential gauge, it pumped 66 barrels of 26.5° gravity oil and 35 barrels of water per day from 4,690 to 4,767 feet after treatment with 14,500 gallons of acid. This pay zone is correlated with the same zone in the Clear Fork which produces in the Lubbock pool which has been called the "Nairn pay." The Stinnett No. 1 was drilled on a seismograph prospect to 7,000 feet and plugged back to 5,372 feet for completion. At total depth, it had probably penetrated Pennsylvanian rocks although the base of the Permian is not marked by any noticeable break in sedimentation.

Three wildcats in Lubbock County and one in Hockley County sought production from the "Nairn pay" of the Clear Fork without success. Three miles south of the discovery well of the Lubbock pool, J. R. Sharp *et al.* T. A. Holman No. 1, Sec. 12, Block B, J. H. Gibson Survey, was low and found very little porosity and no oil stain in the "Nairn" zone from 5,040 to 5,200 feet. It was abandoned at 5,505 feet. In western Lubbock County, J. R. Sharp's Elliott No. 1, Sec. 33, Block D-5, E. L. R. R. Survey, drilled a broken section without porosity from 5,300 to 5,400 feet equivalent to the "Nairn pay" zone and was abandoned at 6,410 feet. In the southwest corner of Lubbock County, George P. Livermore's Moxley No. 1, Sec. 24, Block 20, H. E. & W. T. Survey, drilled a thick San Andres section, found only light porosity in the "Nairn" zone from 5,850 to 5,950 feet, and was abandoned at 6,406 feet. In northern Hockley County, the Stanolind Oil and Gas Company's Williams No. 1, testing a seismograph prospect, found the "Nairn" zone to be nearly all anhydrite and was abandoned at 6,500 feet.

Two wildcats in Swisher County drilled through the Clear Fork into the Wichita before finding a porous dolomite section thick enough to contain oil in commercial quantities. The Weiner and Gourley's Kleen No. 1, Sec. 120, Block M-10, B. S. & F. Survey, found the San Andres at 1,800 feet, the Clear Fork at 3,300 feet, and the Wichita at 4,850 feet, and was dry and abandoned at 5,226 feet. Both the San Andres and Clear Fork sections consisted of alternating beds of salt, anhydrite, and dolomite with layers of red shale. The L. A. Helms' Harris No. 1, Sec. 103, Block M-10, B. S. & F. Survey, encountered the same type of section and was abandoned at 5,514 feet. The top of the Wichita was found at 4,660 and the top of the Wolfcamp is probably close to 5,400 feet. The section from 5,100 to 5,280 feet consisted of brown granular slightly porous dolomite with no oil stain, probably containing water.

A. *Tubb pay zone.*—The Tubb pay zone is herein considered to be approximately middle Clear Fork in age; hence, is included in the Yeso-Clear Fork group. Two of the most important discoveries of the year were in the Tubb pay zone. The first was the opening of Tubb pay zone production on the Embar structure in southern Andrews County which has been named the Embar Per-

mian field. The Phillips Petroleum Company's University-Andrews No. 9 was low on the top of the Ellenburger at 8,125 feet and was plugged back from 8,174 to 6,275 feet for a test of the Tubb zone which was found at 6,080 feet. "Pay" from 6,210 to 6,275 feet was treated with 6,500 gallons of acid and the well had an initial gauge of 264 barrels of 44° gravity oil per day, flowing through open tubing with a gas-oil ratio of 1181:1. Several tests on the west and north side of the Embar structure failed to find sufficient porosity in the Tubb zone to develop commercial production.

The second important area of Tubb pay zone production is the Monahans pool in northern Ward County. On the basis of tests made on its Sealy-Smith Foundation No. 1, the Shell Oil Company, Inc., drilled its Sealy-Smith Foundation No. 2 as a Tubb pay zone test in Sec. 38, Block A, G. & M. M. B. & A. Survey. The top of the Tubb zone was found at 5,515 feet, and 5,210,000 cubic feet of gas was recorded on a drill-stem test from 5,595 to 5,655 feet, with an estimated 25 barrels of oil per hour. Drilling was continued to 5,741 feet with water showing in a drill-stem test from 5,648 to 5,691 feet, after which the well was plugged back to 5,660 feet. Casing from 5,633 to 5,643 feet was perforated with 30 shots and the section was treated with 1,500 gallons of acid. On potential test, the well flowed 759 barrels of 34.5° gravity oil per day with a gas-oil ratio of 1624:1. The Monahans pool, which also produces from the Ellenburger, was discovered as a result of seismic work.

Three miles south of the old Tubb pool in Crane County, Tubb pay zone production was developed in 1942 in the south extension of the Sand Hills (Ordovician) pool. The Shell Oil Company, Inc., Barnsley No. 1, Sec. 30, Block B-27, P. S. L. Survey, on the west side of the field, drilled to 5,667 feet and showed water in the Ellenburger from 5,639 to 6,667 feet. On the basis of a drill-stem test from 4,165 to 4,226 feet, which had yielded 2,100 feet of oil and 196,000 cubic feet of gas in 30 minutes, the well was plugged back to 4,252 feet and the casing perforated from 4,174 to 4,216 feet with 66 shots. After treatment with 7,000 gallons of acid, the well registered a potential gauge of 581 barrels of 36.8° gravity oil and 22 barrels of water per day, flowing through a 40/64-inch choke on tubing with a gas-oil ratio of 1068:1. At the end of the year, one other well, the Gulf Oil Corporation's W. N. Waddell *et al.* No. 39, had been completed in this zone.

An important Tubb pay zone test which at the end of the year was in the process of being completed as a producer and opener of a new pool was the Shell Oil Company's Leaverton No. 1, Sec. 458, Block G, C. C. S. D. & R. G. N. G. Survey, Gaines County. As mentioned, the well is 4 miles southwest of the Wasson field, on the southeast edge of another structure. The section penetrated from the top of the San Andres at 4,540 feet to the total depth of 7,772 feet is a thick sequence of dolomite beds of San Andres and Yeso-Clear Fork age with three sand and sandy dolomite zones: one at 6,060 to 6,260 feet; a second at

6,530 to 6,590 feet; and a third at 7,350 to 7,440 feet. The top of the Tubb zone is at 7,440 feet, and, from 7,490 to 7,772 feet, the samples showed porosity and oil stain.

Two tests in Andrews County went sufficiently deep to test all of the Permian rocks of the area. The Humble Oil and Refining Company's Sims *et al.* No. 1, Sec. 24, Block A-29, P. S. L. Survey, drilled to 9,438 feet, was not far below the base of the Permian at that depth. The Tubb pay zone, found at 6,830 feet, showed only slight porosity, and the Fullerton pay zone at 7,250 to 7,400 feet, contained much anhydrite and green shale with no porosity. Fifteen miles northwest of the Embar pool, the Atlantic Refining Company drilled a test to 10,760 feet into the Ellenburger on a seismograph prospect. The well, the Texas-University No. 1-A, Sec. 9, Block 12, University Lands Survey, also found no porosity in the Tubb pay zone at 6,480 feet and very little porosity in the Fullerton pay zone from 7,000 to 7,200 feet.

A deep Permian test was drilled on the east side of the Midland basin in Martin County. The Magnolia Petroleum Company's E. B. Powell No. 1, Sec. 18, Block 35, T. 1 N., T. & P. Survey, found no encouraging showings in drilling to 8,318 feet, assumably still in Permian. The Clear Fork, found at 5,790 feet, consisted of dark non-porous limestones with black shales. From 7,100 to 8,318 feet, 40 per cent of the rocks were tight sands interbedded with dark limestones and black sandy shales.

DEVELOPMENTS IN PRE-PERMIAN OF WEST TEXAS

Development in 1942 in West Texas, in pre-Permian exploration, was the greatest in the history of the area. The areas of greatest activity were in Pecos, Reagan, Crane, and Andrews counties. Pre-Permian exploratory work is trending northward along the Central Basin platform with considerable development on the eastern platform and the western side of the Central Basin platform extending even into southeastern New Mexico. In West Texas at the close of the year, there were 126 pre-Permian wells completed, and 28 active drilling wells.

NEW DISCOVERIES

The Phillips Petroleum Company's University-Andrews No. 2, Sec. 30, Block 10, southwestern Andrews County, near the south county line, was completed in May, with an initial potential of 1,422 barrels of 44.5° gravity oil in 15 hours, producing from upper Ellenburger. Ten wells have been completed, five Ellenburger producers, one dry in the Ellenburger but plugged back to the Permian for production, and four dry holes. This structure comprises a very small area, in which the pay zone ranges from 7,770 to 7,950 feet. This Embar pool was found by using a combination of core drilling and subsurface geology.

The Magnolia Petroleum Company's Glenn No. 1, in the northeast corner of Sec. 20, Block 1, H. & T. C. Survey, about 2 miles north and east of the Abell

pool of Pecos County, found production in the McKee sand. The well was completed at 6,186 feet in the Simpson, producing 226 barrels of 43.2° gravity oil per day, with a gas-oil ratio of 615:1. At the close of the year an offset was drilling. This pool, which is called the McKee, was found by subsurface geology.

The Shell Oil Company's Sealy-Smith Foundation No. 1, Sec. 38, Block A, G. & M. M. B. & A. Survey, in northeast Ward County, was completed in August, 1942, at 10,364 feet, plugged back from 10,545 feet. This is one of the outstanding new fields of West Texas, called the Monahans pool. The Tubb pay zone production, which was at approximately 5,600 feet, was passed up. This well, the deepest producer in West Texas, had an initial potential of 2,852 barrels of 46° gravity oil, a gas-oil ratio of 2,054:1. Seven and five-eighths-inch casing was set at 10,077 feet. The top of pay was encountered at 10,082 feet. Near the total depth the operators encountered water which they found difficult to plug off, and finally cemented off some of the pay section. The well can probably produce considerably more than 500 barrels of oil per hour from its full pay section. It penetrated Mississippian, Devonian, Silurian, upper and middle Ordovician rocks, and drilled 463 feet of Ellenburger section.

W. F. Morgan's Craft No. 1 is in Sec. 276, Block 1-A, H. & T. C. Survey, in the northeast part of Coke County. It was completed at 3,828 feet in Pennsylvanian rocks as a pumper, opening the Blackwell pool. The initial potential was 175 barrels of 41.5° gravity oil per day. The "pay" was encountered at 3,821 feet and was acidized with 5,500 gallons. This discovery can be credited to subsurface geology.

S. B. Roberts' Allison No. 2, Sec. 25, Block K, G. H. & S. A. Survey, Sutton County, was completed at 3,761 feet in a Pennsylvanian sand with an initial potential of 6,640,000 cubic feet of sweet gas. It was located by subsurface geology.

Dodson and Abernathy's Wilson No. 1, in the No. 1 Thomas Green Survey of southwestern Concho County was stopped at 4,102 feet in Ellenburger. It was plugged back to 3,752 feet as a small producer in a Pennsylvanian sand. It is called the Dodson pool.

FIELD DEVELOPMENT

Ellenburger production of Crane County.—There was no further development in the Gulf "A" Tubb area on the south end of the Sand Hills field, but in the Tubb "B" area, 2½ miles south, seven wells were drilled into the Ellenburger, of which six made producers in the Ellenburger and one was plugged back to the Tubb zone in the Permian for production. In the Gulf-Waddell *et al.* area, 1½ miles south, four wells were drilled to the Ellenburger, of which three produced from this zone and the fourth, although dry in the Ellenburger, produced in the Tubb zone after being plugged back.

Simpson and Ellenburger production (Middle Ordovician), Abell field, Pecos County, Texas.—The Abell field has had a very rapid development because of

short-term leases. The field is now rather definitely outlined. Fifty-one wells were completed in 1942, seven of which were dry holes and four failed to produce in the Ordovician, but were plugged back to the Permian as producers. Eight wells were completed in the Ellenburger as producers and two were dry in the Ellenburger, one of which made a Permian producer. Thirty-two were completed as producers in the Simpson formation, either in the McKee or Waddell sands. The Skelly Oil Company's Grove No. 1 was the record Ellenburger producer in this field, having an initial potential flowing 853 barrels of 43.3° gravity oil in 24 hours after an acid treatment.

Other Ellenburger production of Pecos County.—The Apco pool this year has had considerable development. Twelve wells were completed, of which eleven were producers and one a dry hole. One well was actively drilling at the close of the year. One well encountered some saturated sand in the lower Ellenburger section, which may be equivalent to the Hickory sand, Cambrian in age. Initial potentials in this field have been as high as 2,247 barrels of oil per day, some wells having a natural flow of more than 1,000 barrels of oil per day. The limit of production is still not outlined on all sides of the pool.

Reagan County, Ellenburger production.—The Barnhart pool of southeastern Reagan County was very active in 1942. Although production is below 9,000 feet in the Ellenburger, nine wells were completed as producers and at the close of the year there were five drilling wells. The Ellenburger structure of the field is fairly well outlined on the east and south, but it is still open on the west and north-northwest. The field has developed into one of the major pools of West Texas with possibilities of extending north and northwest.

The Big Lake field of southwestern Reagan County had one failure in the Ellenburger. The Big Lake Oil Company deepened its 20-C University Lands well from 2,975 feet to 9,385 feet, hoping to extend Ellenburger production northward. The operators drilled more than 800 feet of Ellenburger without encountering oil or water.

Schleicher County.—The Cooper Gas Company's Bert Page No. 1-D, Sec. 39, Block L, G. H. & S. A. Survey, drilled approximately 550 feet of Ellenburger from 6,487 to 7,022 feet but it was non-productive. It was then plugged back to 5,630 feet in the Pennsylvanian as a gas well. The initial potential was 30,000,000 cubic feet of gas and 109,914 cubic feet of gas distillate.

Pecos County (Cambro-Ordovician).—In the Gulf-Wentz pool, northeast central Pecos County, the Gulf Oil Corporation's Miller No. 3 was completed as a producer in Cambrian sand although it drilled into the pre-Cambrian where it stopped at 4,406 feet. The Gulf's Miller No. 2, a producer, was deepened into the pre-Cambrian. This field structurally is the highest pre-Permian production in West Texas.

Strawn production (lower Pennsylvanian).—The Todd field of Crockett County had only two completions in 1942. One was dry and abandoned in the Ellen-

burger at the total depth of 6,305 feet, or a total penetration of 23 feet in Ellenburger, and the other produced from the "crinoidal" limestone of Pennsylvanian age.

PRE-PERMIAN WILDCATS

The Atlantic Refining Company's Texas University No. 1-A was located in Sec. 9, Block 12, University Lands Survey, in southwest central Andrews County. Rocks below the base of the Permian and the top of the Montoya have not been definitely identified. A short Simpson section overlies the Ellenburger which was penetrated 185 feet where sulphur water was encountered. The well was abandoned at 10,760 feet.

The Humble Oil and Refining Company's Simms No. 1, Sec. 24, Block A-29, Public School Land Survey, in the northwest corner of Andrews County, was dry and abandoned at 9,438 feet, in sedimentary rock of undetermined age, probably pre-Permian.

The Phillips Petroleum Company's Montague No. 1, Sec. 6, Block B-4, A. B. & M. Survey of Briscoe County, was dry and abandoned at 8,200 feet probably in Mississippian black shale.

Fain and McGaha's Nicholas No. 1, Sec. 337, Block A-1, H. & T. C. Survey in Coke County, 5 miles south of Morgan's Craft No. 1, a new discovery, was dry and abandoned at 3,830 feet in Pennsylvanian rocks.

The Gulf Oil Corporation's Dawson No. 1, Sec. 10, Block 6, H. & T. C. Survey, in southeastern Crane County, was dry and abandoned at 5,505 feet, in Ellenburger which was penetrated 200 feet. Approximately 150 feet of lower Simpson overlies the Ellenburger.

The Skelly Oil Company's Richardson No. 1, Sec. 5, Block 31, H. & T. C. Survey, southeastern Crane County, near the Pecos River, was dry and abandoned at 5,743 feet. About 470 feet of Simpson overlies the Ellenburger which was penetrated 278 feet.

The Amerada Petroleum Corporation's Todd No. 1-G, Sec. 15, Block WX, G. C. & S. F. Survey, Crockett County, 1¾ miles southeast of the Amerada's Todd No. 1-C, a small "crinoidal" limestone producer, was dry and abandoned at 6,890 feet in Ellenburger, failing to show anything in the Strawn limestone.

The Amerada Petroleum Corporation's Todd No. 1-H, Sec. 16, Block 10, G. C. & S. F. Survey, Crockett County, a semi-wildcat one mile north of the Amerada's Todd No. 1-C, was dry and abandoned at 7,078 feet in Ellenburger. The "crinoidal" limestone showed sulphur water and the Ellenburger showed nothing.

The Moore Exploration Company and Olson Drilling Company's Halff No. 2-C, Sec. 68, Block 1, H. & G. N. Survey, Crockett County, between the Yates and Noelke pools, was dry and abandoned at the total depth of 6,977 feet in Ellenburger.

Moncrief and Helmerich and Payne's Couch No. 1, in Sec. 30, Block QR,

G. C. & S. F. Survey, 8 miles southwest of the town of Ozona, Crockett County, was dry and abandoned at the total depth of 6,523 feet, probably in Pennsylvanian rocks.

The Humble Oil and Refining Company's Matador Land and Cattle Company No. 2, Sec. 5, Block L, Shock and Arnold Survey, Dickens County, was dry and abandoned at 6,314 feet in Canyon limestone.

Dan Auld's Hanking No. 1, Sec. 63, Block E, H. E. & W. T. Survey of Edwards County, was dry and abandoned in the Pennsylvanian at 4,310 feet.

The Stanolind Oil and Gas Company's Hopping No. 1, Sec. 25, Block T, T. A. Thompson Survey, Lamb County, was dry and abandoned in metamorphic rock at 9,624 feet, with only approximately 150 feet of Ellenburger overlying the pre-Cambrian.

The Anderson-Prichard Oil Corporation's Bowen No. 1, Sec. 60, Block 10, H. & G. N. Survey, north-central Pecos County, about 2½ miles west of the Apco pool, was dry and abandoned at the total depth of 5,200 feet, 283 feet in the Ellenburger. Below the Permian, a short detrital section overlies the Ellenburger where sulphur water was encountered.

The Anderson-Prichard Oil Corporation and Magnolia Petroleum Company's Powell No. 1, Sec. 98, Block 10, H. & G. N. Survey, Pecos County, a mile northwest of the Apco pool, was dry and abandoned at 5,318 feet in Ellenburger which contained sulphur water. The Ellenburger is overlain by a thin section of lower Simpson.

The Anderson-Prichard Oil Corporation's Ogilvie No. 1, Sec. 30, Block 140, T. & S. T. L. Survey, about 7 miles west and south of the Apco pool in Pecos County, was abandoned at 6,652 feet in the Simpson formation above the Waddell sand. Below the Permian, a thick detrital section overlies the lower Silurian which was encountered at 5,395 feet; the Simpson was found at 5,675 feet.

The Gulf Oil Corporation's Shearer No. 1, Sec. 135, Block 10, H. & G. N. Survey, Pecos County, about 6 miles east of the Apco pool, was dry and abandoned at 4,150 feet in Ellenburger which was penetrated 55 feet, where flowing sulphur water was encountered.

M. D. Bryant and McCandless *et al.* McDonald No. 1, Sec. 46, Block 12, H. & G. N. Survey, 4½ miles east and south of the Gulf-Wentz pool of northeast central Pecos County, was dry and abandoned at 5,666 feet, where sulphur water was encountered about 400 feet below the top of the Ellenburger. A very thick detrital section, about 500 feet, overlies the Ellenburger which was encountered at 5,275 feet.

The Magnolia Petroleum Company's Price No. 1, Sec. 4, Block 12, H. & G. N. Survey, Pecos County, about 4 miles northeast of Bryant *et al.* McDonald No. 1, encountered a thick detrital section similar to that in the McDonald well overlying the Ellenburger. The operator abandoned the well at 5,506 feet in Ellenburger.

The Stanolind Oil and Gas Company's Wagner No. 1-C, Sec. 31, Block 9, H. & G. N. Survey, Pecos County, about one mile north of its Conry-Davis No. 1, which was drilled in 1941 through the Ellenburger into pre-Cambrian igneous rock, was dry and abandoned in the Ellenburger.

Livermore and Wahlenmaier's Thompson No. 1, Sec. 75, Block TT, T. C. R. R. Survey, Schleicher County, was dry and abandoned at 7,021 feet, about 400 feet below the top of the Ellenburger.

The Gulf Oil Corporation's Foster No. 1-C was located in Sec. 28, Block 12, S. P. & R. R. Survey of Sterling County. The total depth was 8,117 feet in Ellenburger encountered at 8,080 feet, and it showed sulphur water.

The Dominion Oil Company's Allison No. 1, Sec. 91, Block 9, T. W. & N. G. Survey in Sutton County, was dry and abandoned at 4,676 feet in Pennsylvanian rocks.

S. B. Roberts' Allison No. 1, Sec. 44, Block K, G. H. & S. A. Survey in Sutton County, about 11 miles southeast of the Page gas field, was dry and abandoned at the total depth of 5,416 feet in Ellenburger.

The Plymouth Oil Company's Alford No. 1, Sec. 50½, Block Y, P. B. Scott Survey of Upton County, was dry and abandoned at 10,384½ feet in Devonian chert.

DEVELOPMENTS IN SOUTHEASTERN NEW MEXICO IN 1942

As in 1941, a very large percentage of the wells drilled in southeastern New Mexico during 1942 were in Eddy County in the Red Lake and Square Lake areas. Many of these were shallow tests. Crude oil production dropped from 39.34 million barrels to 31.93 million barrels, a drop due largely to pipeline proration.

There were 35 wildcat tests drilled, of which 6 were completed as producers. Three producers were ranked as discoverers of new pools, and three extended the area of production in established pools. No new producing zones were discovered during the year although one well was drilling at the end of the year, R. Olsen *et al.* Langlie No. 1, Sec. 11, T. 25 S., R. 37 E., in southeast Lea County, which may establish production in the lower San Andres and (or) the upper Ordovician which would be new pay zones for New Mexico.

DEVELOPMENT AND EXPLORATION OF ESTABLISHED PAY ZONES IN PERMIAN

1. *Yates sand and Seven Rivers.*—Northeast of Carlsbad, Eddy County, a new area of oil production from the Yates sand was found by Neil H. Wills' Wills No. 1, Sec. 13, T. 20 S., R. 28 E. On a natural test, the well pumped 27 barrels of 36° gravity oil per day from pay sand topped at 786 in the Yates formation. The test was located downdip from W. A. Sudderth's Wills No. 1, Sec. 14, T. 20 S., R. 28 E., which was completed, producing 3 million cubic feet of sour gas in 1941, the gas "pay" being in the basal Yates or upper part of the

Seven Rivers. The total depth of the Wills' Wills No. 1 was 906 feet. Two other producers were drilled during 1942 in the field which has been named the Russell area.

The Lynn area, T. 23 S., R. 36 E., was extended southeast by the Western Gas Company's Combest No. 1-X, Sec. 35, T. 23 S., R. 36 E., which flowed at the rate of 120 barrels of oil per day from 3,500 to 3,579 feet. This "pay" is in the basal Seven Rivers or upper Queen formation, and the nearest production is a gas well one mile northwest.

Two additional wildcats were drilled during the year on the well defined reef front structure in T. 21 S., R. 32 E. The first was Culbertson and Irwin's Shepherd No. 1, Sec. 1, T. 21 S., R. 32 E., which was dry and abandoned at 3,496 feet after finding sulphur water in the Seven Rivers dolomite at 3,492 feet. The second was Felmont Corporation's State No. 1, Sec. 5, T. 21 S., R. 33 E., which was low and was abandoned at 3,717 feet in the top of the Tansill formation, indicating very steep dip on the northeast flank of this structure.

Drilling in West Eunice pool during the year resulted in gradually extending the field southwest with some good producers, but it was finally defined at this end by two dry holes. Four producers were added to the East Lusk pool in T. 19 S., R. 32 E., discovered late in 1941, and three to the West Lusk pool in T. 19 S., R. 31 E., also discovered late in 1941. The East Lusk pool is a small dome producing in the top of the Seven Rivers formation and on the same trend as the West Lusk pool which is an east-west nose with production in the Yates sand.

2. *Queen formation.*—One new spot of oil production from the Queen formation was found in 1942 in the Shugart area. Culbertson and Irwin's Vandergriff No. 1, Sec. 6, T. 19 S., R. 31 E., was completed, pumping 42 barrels of oil per day after the pay section was shot from 3,303 to 3,353 feet with 130 quarts of nitroglycerine. The "pay" is in sands and dolomite of the Queen formation which was found from 3,195 to 3,573 feet, the total depth. No other well was drilled in the area during the year.

3. *Grayburg formation.*—The Square Lake area in Ts. 16 and 17 S., Rs. 30 and 31 E., discovered late in 1941, had steady development during the year with the drilling of 90 wells. The field now covers 3,760 producing acres. The gap between the two discovery wells of the Square Lake field was closed early in the year by L. H. Choate and C. W. Brown's Hover-State No. 1, Sec. 2, T. 17 S., R. 30 E., which flowed 200 barrels of oil per day after the pay section from 2,903 to 2,978 feet was shot with 150 quarts of nitroglycerine. The "pay" is in sand and dolomite of the Grayburg formation, and the total depth is 2,988 feet.

The Grayburg-Jackson area, T. 17 S., R. 30 E., was extended southeast by English *et al.* Turner No. 1, Sec. 25, T. 17 S., R. 30 E., which pumped 45 barrels of oil and 5 barrels of water per day after the section was shot from 3,334 to 3,396 feet with 120 quarts of nitroglycerine. The Turner No. 1 encountered oil "pay" in the basal Grayburg from 3,340 to 3,385 feet where it filled with 700 feet of oil in 25 hours. It was drilled into the San Andres at 3,408 feet, found salt water

from 3,520 to 3,525 feet, and was plugged back from a total depth of 3,545 feet to 3,450 feet for completion.

4. *San Andres formation.*—There were 12 wildcats drilled as tests of the San Andres formation or deeper. All were dry holes except one, which indicates an area of production between the Maljamar and Vacuum fields. Eight of the wildcats were drilled north of the present northern limits of production in Lea and Eddy counties in attempts to find oil in the deeper San Andres zones which produce in Texas.

A. *Upper San Andres pay zone.*—The new area previously mentioned was opened by the Phillips Petroleum Company's Philmex No. 1, Sec. 28, T. 17 S., R. 33 E., between the Maljamar and Vacuum fields. The test was drilled to 4,771 feet, plugged back to 4,600 feet, at which depth it pumped 25 barrels of oil per day from "pay" topped at 4,484 feet. The top of the San Andres was at 4,501 feet and sulphur water was encountered from 4,769 to 4,771 feet. No other wells were drilled close to the discovery during the year, but in the same township, the Richmond Drilling Company's Shell-State No. 1-B, Sec. 10, T. 17 S., R. 33 E., was dry and abandoned at 4,805 feet after finding nothing in the upper San Andres.

On a trend northeast of the South Lovington field and between it and the Wasson field in Texas, the Richmond Drilling Company's State No. 1, Sec. 5, T. 16 S., R. 38 E., was dry and abandoned at 5,508 feet, having penetrated the San Andres 458 feet without finding any showings.

B. *Wasson pay zone.*—The Neville G. Penrose State No. 1, Sec. 22, T. 16 S., R. 36 E., northwest of the South Lovington field, was drilled to 5,501 feet without finding porosity in the upper San Andres pay zone or oil showings in the section equivalent to the Wasson pay zone, and it was plugged and abandoned.

C. *Slaughter pay zone.*—There were no discoveries from the Slaughter pay zone in New Mexico, but several exploratory tests were drilled to this zone in the country north of Lovington and east of the Pecos River. George P. Livermore's Maxwell-State No. 1, Sec. 25, T. 15 S., R. 34 E., Lea County, was drilled to the total depth of 6,308 feet without finding important showings. The Slaughter pay zone which was reached from 5,300 to 5,400 feet was slightly porous with scattered oil stains, but was not considered worth testing. At 6,308 feet the well was probably just through the equivalent of the Glorieta sand although no sand of the Glorieta type was found.

Twenty miles north of the Livermore well, the American Drilling Company drilled Tide Water-State No. 1, Sec. 18, T. 12 S., R. 35 E., on a subsurface nose extending southeast into the basin. The well drilled a saturated section in the Slaughter pay zone from 4,910 to 5,020 feet which failed, however, to develop production after being treated with 2,000 gallons of acid at the depth of 5,020 feet. It was drilled to 5,175 feet and abandoned.

Another Slaughter pay zone test which had encouraging showings was the Ohio Oil Company's State-McCormick No. 1, Sec. 36, T. 19 S., R. 37 E., north-

east Lea County. Saturation and porosity were encountered from 4,975 to 5,000 feet in the Slaughter pay zone, and 4½-inch casing was set and cemented at 4,943 feet. On natural test, the well was swabbed dry, and was treated with 1,000 gallons of acid, after which 43 barrels of fluid, 15 per cent oil and 85 per cent salt water, were swabbed in 9 hours. The well was then deepened to 5,658 feet, going into Glorieta sand at 5,651 feet. After being plugged back to 4,995 feet and being tested further, the well was finally plugged and abandoned.

IMPORTANT PRE-PERMIAN TESTS

In De Baca County, the South Basin Oil Company's Good No. 1, Sec. 5, T. 4 N., R. 20 E., was drilled to 4,779 feet where it was dry and abandoned in schist of the pre-Cambrian. The top of the Pennsylvanian was at 3,710 feet and continued to the top of the pre-Cambrian at 4,750 feet.

In southeast Lea County, an important pre-Permian test drilling at the end of the year was R. Olsen *et al.* Langlie No. 1, Sec. 11, T. 25 S., R. 37 E. This test went out of the Permian at 7,460 feet and at the end of the year it was drilling at 8,000 feet to test the Ellenburger of the lower Ordovician. Encouraging porosity and saturation were found from 4,800 to 5,000 feet in the basal San Andres.

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DEVELOPMENTS IN NORTH AND WEST-CENTRAL TEXAS IN 1942[1]

NORTH TEXAS GEOLOGICAL SOCIETY[2]
Wichita Falls, Texas

ABSTRACT

During 1942 the north and west-central Texas area contributed 38 new discoveries and 12 extensions of proved fields or successful completions in new pay zones in areas already productive. This compares with 33 new discoveries and 11 extensions during 1941. According to available information the discovery methods responsible for these new producing areas are as follows: 3 random drilling, 4 surface geology, 11 subsurface geology, 14 seismograph, 1 geochemical, and 5 a combination of two or more methods.

The discovery of oil in Simpson rocks in Montague County is probably the most important development during 1942. The extent or profitability of Simpson production remains speculative at this time, but the addition of this objective in the Fort Worth basin enhances the possibilities of the area. The discovery of Marble Falls production in the Forestburg pool in southeastern Montague County is also important.

Seismograph mapping continues to be an effective method of exploration in the district.

INTRODUCTION

The north and west-central Texas districts include the area extending from the Llano uplift in central Texas, northward to the Red River and from the eastern rim of the Midland basin on the west side to include the Fort Worth syncline on the east side.

The major structural features of the area are the Bend arch extending due northward from the Llano uplift into Wichita County, flanked on the east by the Fort Worth syncline, which, commencing at approximately the center of the west line of Clay County, extends in depth southeastward through Clay County, across southern Montague County, through northeastern Wise County, and across central Denton County. The Electra arch extends from northern Clay County westward across north Wichita County and central Wilbarger and Foard counties. The Muenster arch extends through the southeast corner of Cooke County diagonally across that county toward the northwest and through northeastern Montague County. The Red River syncline parallels the Electra arch on the north and increases in depth westward as it enters Wilbarger County and continues to deepen westward through northern Hardeman County.

[1] Presented by title before the Association at Forth Worth, April 7–9, 1943. Manuscript received, March 13, 1943.

[2] Several authors prepared this article, describing the development by counties: Clay County, by W. C. Bean, Shell Oil Company, Inc., Wichita Falls; Coleman County, by M. G. Cheney, Anzac Oil Corporation, Coleman; Young, Wise, and Parker counties, by Clinton Engstrand, Shell Oil Company, Inc., Wichita Falls: Jack County, by J. F. Gibbs, Standard Oil Company of Texas, Wichita Falls; Childress, Cottle, King, Knox, Foard, Hardeman, and Baylor counties, by D. D. Heninger, Ohio Oil Company, Wichita Falls; Wichita County, by John A. Kay, consultant, Wichita Falls; Montague County, by P. M. Martin, Continental Oil Company, Wichita Falls; Jones and Shackelford counties, by T. F. Petty, Humble Oil and Refining Company, Wichita Falls; Taylor County, by Robert Roth, Humble Oil and Refining Company, Wichita Falls; Archer County, by H. F. Smiley, Bridewell Oil Company, Wichita Falls; Wilbarger County, by S. V. White, Consolidated Oil Company, Wichita Falls.

CLAY COUNTY

The only important new field discovered in Clay County in 1942 is the Watson field, 21 miles southwest of Henrietta and 2 miles northeast of the Henderson (Antelope) field. The discovery well, Roy Lee, Trustee's H. Watson No. 1, in the W. A. Farris Survey, was completed in February with an initial production of 88 barrels of 43° gravity oil in 3 hours from a porous limestone at 5,454–5,485 feet, total depth. This limestone may probably be included in the Caddo group although it is about 250 feet below the top of that limestone sequence. At the close of the year six additional oil wells have been completed in this pay zone, and two oil wells southeast of the Caddo wells are producing from a Strawn sandstone at about 3,650 feet. Two wells in the field were drilled deep enough to penetrate the upper part of the Ellenburger dolomite, but found no oil below the Caddo pay zone.

The Worsham field in eastern Clay County received two important extensions through the completion of Gulf Oil Corporation's Worsham Nos. 6 and 8, both producing from Caddo limestone. Worsham No. 6, in Sec. 37, Block 4, H. & T. C. R. R. Survey, about one mile north of the nearest Caddo production, was completed with an initial production of 656 barrels of oil in 8 hours from Caddo limestone topped at 5,482 feet. Worsham No. 8, about one mile north of No. 6, was completed with an initial production of 164 barrels of oil per day on the pump.

The Joy field in southwestern Clay County, discovered late in 1941, was extended more than ½ mile northeast by the completion of five additional wells producing from Chappel limestone. The best well completed in the field to date is the Shell Oil Company's Brock No. 1, which yielded an initial flow of 266 barrels of oil in 2 hours after acidization of Chappel limestone from 5,942 to 6,021 feet, total depth. A new pay zone was discovered and the field extended about ½ mile eastward by the completion of the Shell Oil Company's Clark No. 3 with an initial production of 71 barrels in 24 hours from a Strawn sandstone at 3,950–3,980 feet.

COLEMAN COUNTY

On a percentage basis, wildcat drilling in Coleman County was reasonably successful in 1942. Four new oil pools and two new gas fields were discovered. The "Ranger lime" (Big Saline) producing area of the Santa Anna gas field was extended 2 miles southwest and considerably northeast. A small oil well was added from the Caddo limestone in the old Camp Colorado field. These results came from less than 20 exploratory wells.

By the end of 1942, six producers and two dry holes had been completed in the new Coker field, 3 miles northeast of Novice in the northwest part of the county. This discovery was based on surface mapping by H. H. Adams and a 20-barrel showing obtained in the Manhattan Oil Company's Featherston No. 1, drilled 15 years ago. A new completion, 160 feet from this early test, came in

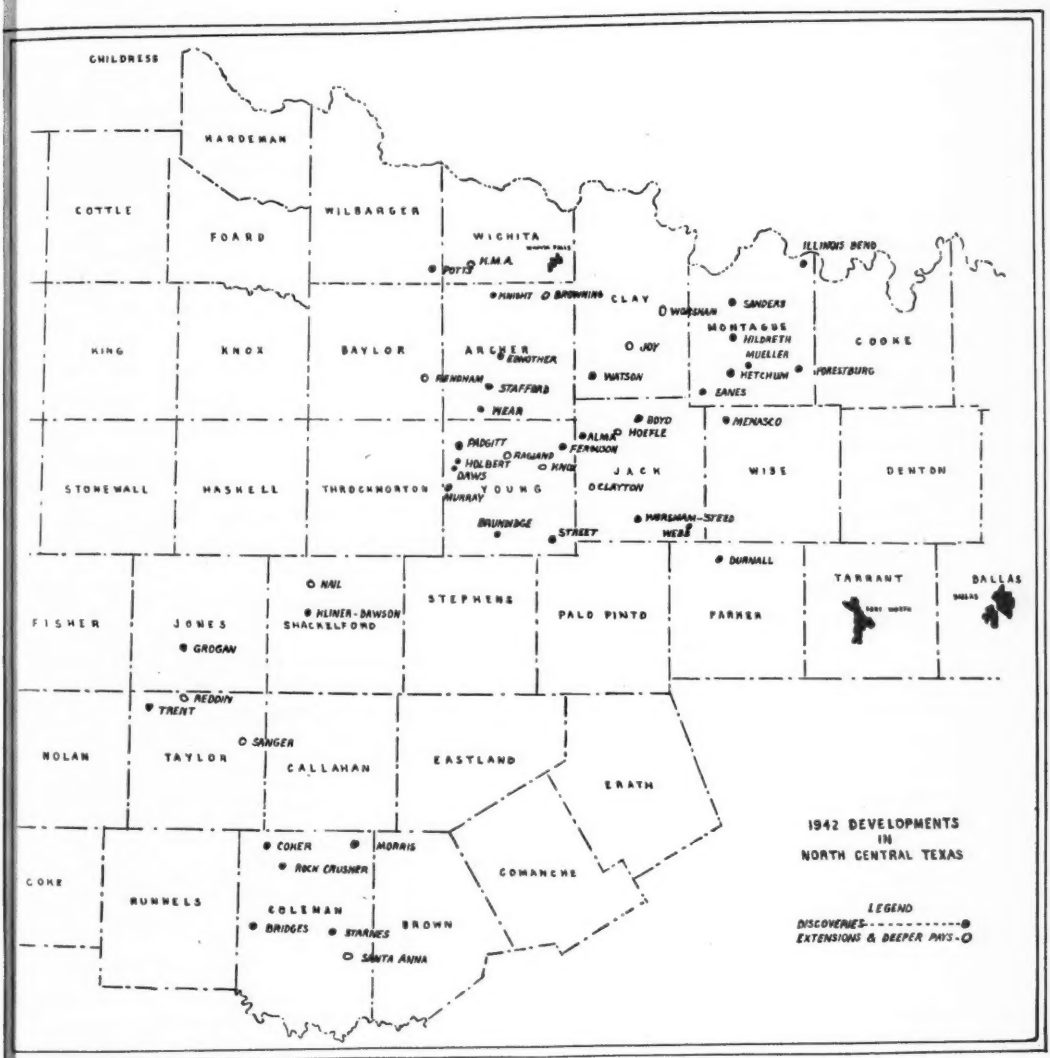

CHILDRESS
HARDEMAN
COTTLE
FOARD
WILBARGER
WICHITA
KING
KNOX
BAYLOR
ARCHER
CLAY
MONTAGUE
COOKE
ILLINOIS BEND
STONEWALL
HASKELL
THROCKMORTON
YOUNG
JACK
WISE
DENTON
FISHER
JONES
SHACKELFORD
STEPHENS
PALO PINTO
PARKER
TARRANT
DALLAS
NOLAN
TAYLOR
CALLAHAN
EASTLAND
ERATH
COMANCHE
COKE
RUNNELS
COLEMAN
BROWN
1942 DEVELOPMENTS
IN
NORTH CENTRAL TEXAS
LEGEND
DISCOVERIES
EXTENSIONS & DEEPER PAYS

FIG. 1

flowing 300 barrels per day, natural. Six wells have had total initial production of about 2,100 barrels from the Morris sand which occurs at the base of the Canyon series just above the Capps limestone. This field is expected to cover at least 320 acres.

Probably of less importance was the Anzac Oil Corporation-Semmes' J. P. Morris Estate No. 41 completed as a 25-barrel producer from the Cross Cut sand at 2,033–2,063 feet, 8 miles northwest of Burkett. A second test ¼ mile north encountered a hole full of water in this sand.

As the year closed, Ellis and Estes' W. C. Ray No. 1, located a mile southwest of Rock Crusher, was completed as an oil well in the Gardner sand, total depth, 3,141 feet. This area has been held in esteem for some time because of favorable surface structural features, but the potentialities of this well and area remain uncertain at this early date.

A 10-barrel pumper was completed by C. Kroll in his Starnes No. 1, ⅓ mile south of Coleman Junction, the "pay" being the Breneke or Morris sand from 1,996 to 2,017 feet. The production test, before cementing casing, had shown 20 barrels of oil per day.

Ellis and Estes' Bridges No. 1, a wildcat 2 miles southeast of Talpa, was completed in the Strawn sand at 3,386–3,414 feet as good for 2 million cubic feet of gas daily. The Woodley Petroleum Company completed its Thompson No. 1 in the Morris sand at 2,807–2,839 feet, with initial production of 3 million cubic feet per day. This well is 1½ miles east of Silver Valley. A second test, ⅔ mile southwest, failed to produce.

R. M. Coleman's Kingsbury No. 1 extended the Santa Anna gas field 2 miles southwest, giving this field a total length of 10 miles. The maximum width is about 2 miles. A large reserve of gas remains in this field which has been producing for the past 20 years with only 15 per cent pressure decline. Geologically the field is interesting because of the association of heavy oil with extensive 0.67 gravity gas accumulation. The oil is 26° gravity A. P. I. with high lubricating oil content, in a zone which normally produces 40° gravity oil. Accumulation occurs where 100 feet of limestone changes to shale on a broad structural feature, with average northwest dip of about 75 feet per mile. This transition from limestone to shale in the Big Saline beds in the subsurface, which occurs in the area at a depth of 2,200 feet, evidently has its counterpart in the area of outcrop around the north and east part of Llano uplift. The very coarse chert conglomerate which commonly occurs at the base of the Big Saline group produces oil in the Gayle pool near Echo in northeast Coleman County.

Only a few wells were added to the older producing fields of Coleman County during 1942. The county produced 787,612 barrels from 424 oil wells, about 80 of which are still flowing; the total production in this county has now exceeded 12 million barrels.

YOUNG COUNTY

Shallow drilling showed a marked decline in Young County in 1942 but during this period seventeen deep exploratory tests were drilled, fourteen of which were located in wildcat territory and three tested deeper objectives in fields already producing. Of the seventeen deep tests, one was completed as a Strawn sandstone producer, three as oil wells, and one as a gas well in the Caddo limestone, one as an oil well in the Marble Falls formation, four as Chappel limestone (Mississippian) oil discoveries, and only seven (41 per cent) were completed as failures. Although the areal extent of these new producing areas remains speculative, pending further development, it appears that several are of only marginal importance, probably not being capable of yielding enough oil to pay for the cost of their exploitation. The Chappel limestone fields, although restricted to small areas, will probably yield a good profit but none of these fields can be classified as of major importance.

In the north-central part of the county, L. T. Burns completed his Williams No. 1 in the Chappel limestone at a depth of about 4,900 feet, with an initial production of 124 barrels of oil in 3 hours, following acidization with 2,000 gallons. This well is an east offset to Burns' Ragland No. 1, an abandoned Caddo limestone producer which penetrated the Chappel limestone but failed to test this formation before being plugged back. Following the successful completion of the Williams No. 1, Burns re-completed his Ragland test in the Chappel limestone, and development in this field to date consists of four Chappel limestone wells, one Caddo limestone producer, and one failure defining production on the east. This prospect was discovered on the basis of seismograph mapping.

In the Knox field, which has been producing from a Strawn sandstone and the Caddo limestone since 1931, the Mudge Oil Company discovered Chappel production in its Harrison No. 10. This well penetrated saturated limestone from 4,764 to 4,770 feet, total depth, and flowed 296 barrels of oil in 6 hours. The northeast offset found sulphur water in the Chappel limestone, this formation being encountered about 70 feet lower than in the Harrison No. 10.

In the northwest part of the county, the Shell Oil Company drilled an exploratory test on a seismograph prospect southeast of the town of Padgitt and this well, the Bullock No. A-1, was successfully completed in the Chappel limestone encountered at a depth of about 4,750 feet. Present development in this field consists of three producers and three failures, production being defined northwestward and southeastward.

Northwest of the town of Murray, the Standard Oil Company of Texas completed its Donnell No. 1 in the Chappel limestone, encountered at 4,460 feet, with an initial production of 88 barrels of oil in 3 hours, flowing natural through $\frac{3}{8}$-inch choke. The northwest offset, the only other test in this pool, encountered the Chappel limestone structurally low and failed to encounter commercial quantities of oil. This discovery was drilled on a seismograph prospect.

In the northeastern part of the county, Talbot *et al.* discovered a Strawn sandstone field by the successful completion of their Ferguson No. 1, which is producing from a zone about stratigraphically equivalent to the Bryson sandstone. The Ferguson No. 1 flowed 101 barrels of oil in 6 hours through a ¾-inch choke on tubing. The drilling of the Ferguson discovery was prompted by a favorable showing of oil encountered in an old 3,654-foot test about ½ mile westward. A dry hole, offsetting the discovery well on the northeast, defines production in this direction.

WISE COUNTY

Only one deep test was drilled in Wise County during 1942. This test, the Stanolind Oil and Gas Company's Menasco No. 1, located 1½ miles south and 4 miles east of the northwest corner of the county, reached the total depth of 7,310 feet and was plugged back and successfully completed in an arkosic conglomerate of lower Pennsylvanian age at 5,790 feet. This well pumped 92 barrels of oil in 24 hours and marks the first commercial production obtained in Wise County. The Menasco No. 1 encountered the base of the Pennsylvanian strata at 6,590 feet and Barnett shale (Mississippian) from 6,590 to 6,830 feet. Below the Barnett shale Ordovician rocks were penetrated to the total depth. This discovery was drilled on a seismograph structure.

PARKER COUNTY

Jones' Darnall No. 1, 5 miles south-southeast of Poolville, reached a total depth of 6,128 feet without encountering any significant showings of oil. This well was subsequently plugged back and a test of a porous limestone found at about 2,800 feet yielded 890,000 cubic feet of gas per day. Pennsylvanian strata were penetrated to the depth of 5,808 feet and Barnett shale from 5,808 to 6,080 feet. Ordovician rocks (Ellenburger) were found from 6,080 to 6,128 feet.

JACK COUNTY

Jack County was one of the most active counties in north-central Texas in 1942 insofar as development of oil prospects was concerned.

Successful completion of producing wells was accomplished in six areas, in various parts of the county.

The Strawn series accounted for one discovery, the Webb field, in the southeastern part of the county. A sand at 2,895–2,905 feet produced 71 barrels daily, at completion. This discovery resulted from seismographic information. The discovery well was Roeser and Pendleton and Cities Service Oil Company's Webb No. 1.

The Bend formation provided a successful extension to the Hoefle field, when the Standard Oil Company of Texas and Hanlon-Buchanan made a producer in

their Griffin No. 1, in Caddo limestone, 4,866–4,874 feet in depth. This well had an initial flowing production of 108 barrels in 6 hours through a 29/64-inch choke on tubing. This area had been thoroughly prospected with seismograph before the well was drilled.

The Worsham-Steed field, 8 miles southeast of Jacksboro, a Bend formation discovery, was opened by Joe A. Worsham's Sewell well No. 1, at 4,693–4,707 feet in sand. By the end of the year there were two producing wells in the pool. The drilling of this well was undertaken on favorable surface geological information.

Hill and Hill's C. P. Clayton well No. 5, a depleted producer in the Bryson pool, was deepened from the 3,000-foot Strawn sand to the total depth of 5,435 feet, 64 feet in the Ellenburger limestone. By plugging back and then perforating, a well producing 20 barrels of oil and 50 barrels of water was obtained at 4,654–4,670 feet, in the Marble Falls formation of the Pennsylvanian system. This well opened a large area for additional drilling and deepening in this part of Jack County.

In the northwestern part of Jack County, the Mississippian provided a small producer in the Alma Oil Company's Maxey No. 1. This well produced 18 barrels of oil and 60 barrels of water, pumping over a period of 24 hours, from the formation at 5,387–5,392 feet, plugged back from 5,665 feet, total depth. This discovery was based on subsurface geology, checked by seismograph.

The first Ellenburger production in the county was obtained in the northeast part of the county when Taubert-McKee and Sinclair Prairie Oil Company's Boyd No. 1 encountered oil at 6,408–6,418 feet. The top of the Ellenburger limestone was found at 6,388 feet. The initial daily potential production was 30 barrels of oil and 170 barrels of water, pumping. The well was drilled on surface geology, checked by magnetometer.

The fields discovered during 1942 were fields in which it is thought that structural conditions, rather than stratigraphic, governed accumulation of oil. Though none of the fields has been developed fully, it is indicated that the Griffin and the Worsham-Steed fields may be the most valuable discoveries of the year. Further development of the county will be encouraged.

CHILDRESS, COTTLE, KING, KNOX, FOARD, AND HARDEMAN COUNTIES

There was very little activity in the extreme northwestern part of the North Texas district in 1942. Only one deep well was drilled, the Mid-Continent Petroleum Company's Burnett Estate No. 1, in the southeastern part of King County, just north of the Stonewall County line. This was an Ellenburger (Ordovician) test drilled on a seismograph prospect. The well penetrated 253 feet of Chappel limestone (Mississippian) before entering Ordovician, and it is the first test to reach these older formations within a radius of 17 miles. No showings of oil or gas were encountered at any depth in this dry hole.

BAYLOR COUNTY

Developments in Baylor County during 1942 were meager, but one well, the Jordan Oil Company's Fayette County School Land No. 1, resulted in a one-mile northeast extension of the Canyon limestone production in the Rendham field. The extension well, however, produces a considerable amount of salt water.

The Mazda Oil Corporation M. A. Wirz No. 1, 3 miles east of Seymour, was the only deep well drilled in the county in 1942 This well was abandoned in Caddo limestone at the total depth of 5,508 feet after failure to encounter any showings of oil or gas.

WICHITA COUNTY

From the point of new fields discovered, the year 1942 was the worst in the 32 years of exploration in Wichita County. One new oil field was found on the J. D. Cooper farm, 5 miles southeast of Burkburnett. At the end of the year two small oil wells and numerous dry holes indicated this field was of no importance. New producing wells in the county were confined to minor extensions of older fields and one new deeper zone on the Hardin farm south of Burkburnett.

K. M. A. FIELD

At the end of 1942 the total developed area of the K. M. A. field (Strawn) included 31,400 acres, approximately 200 acres having been added during the year. In the Ellenburger limestone (Cambro-Ordovician), a total of 6,850 acres were developed, an increase of 2,600 acres for the year. Development and production statistics on both pay zones were as follows.

Pay Zone	*Barrels Recovery 1942*	*Total Barrels Recovery to 12–31–42*	*Total Completed Wells*	*Condition of Wells*		
				Flowing	*Pumping*	*Gas Input*
K. M. A. (Strawn)	8,973,637	43,813,647	1,604	889	615	100
Ellenburger	2,156,569	2,781,229	164	134	30	0

MONTAGUE COUNTY

Twenty-five exploratory tests were drilled in Montague County in 1942, resulting in seven new discoveries, two of which were in new producing zones in the county. Two of these tests were drilled below 8,000 feet; six to depths between 7,000 and 8,000 feet; five between 6,000 and 7,000 feet; two between 5,000 and 6,000 feet; and ten less than 5,000 feet, the shallowest being 2,671 feet.

The outstanding developments were the discovery of oil in porous Marble Falls limestone in the extreme southeast part of the county, by the Sinclair's Jones No. 1, and in Ordovician sands in the central part, by the Continental's Mueller No. 1.

The following are the discoveries completed in 1942.

Continental's J. A. Ketchum No. 1, in Hill County School Land Survey, Abst. 319, Sec. 43
Producing formation: Strawn sand, 3,330–3,338 feet
Initial production: 36.4 bbls., 37° gravity oil, pumping
Total depth: 7,506 feet, in Ellenburger dolomite
Discovery method: Seismograph

Continental's F. and P. Mueller No. 1, in F. Hamilton Survey, Abst. 335, 6 miles east of Bowie
Producing formation: Ordovician sand, 7,218–7,223 feet
Initial production: 368.8 bbls., 45.8° gravity oil in 24 hours through ¾-inch choke on 2½-inch tubing
Total depth: 7,223 feet
Discovery method: Seismograph

R. C. Lipscomb's W. F. Harmon No. 1, in the W. C. Winters Survey, Abst. 842, 3 miles northwest of Illinois Bend
Producing formation: Strawn sand, 3,860–3,865 feet
Initial production: 149.66 bbls., 29.7° gravity oil in 24 hours' pumping
Total depth: 4,982 feet, in Ellenburger dolomite
Discovery method: Surface and subsurface geology

Sinclair Prairie's J. H. Eanes No. 1, in the G. A. Bench Survey, Abst. 1521, 8 miles southwest of Bowie
Producing formation: Bend conglomerate, 5,818–5,830 and 5,912–5,922 feet
Initial production: 70.02 bbls., 41.2° gravity oil in 24 hours through 1-inch choke on 2-inch tubing
Total depth: 7,070 feet in Ellenburger dolomite
Discovery method: Seismograph

Sinclair Prairie's I. M. Jones No. 1, in the I. Singletarry Survey, Abst. 707, 1 mile northeast of Forrestburg
Producing formation: Marble Falls (lower Pennsylvanian) limestone, 7,176–7,320 feet
Initial production: 222.05 bbls., 42.1° gravity oil in 3 hours through open 2-inch tubing
Total depth: 8,696 feet in Ordovician dolomite
Discovery method: Seismograph

Sinclair Prairie's J. M. Sanders No. 1, in Sec. 114, J. C. Mattison Survey, Abst. 471, 4 miles southwest of Nocona
Producing formation: Bend conglomerate 5,962–5,972 feet
Initial production: 375.3 bbls., 36.8° gravity oil in 3 hours through open 2½-inch tubing
Total depth: 5,972 feet
Discovery method: Seismograph

Continental's Jack Hildreth No. 1 in East Texas Railroad Company Survey, Abst. 250, 6 miles north of Bowie
Producing formation: Ordovician sand and dolomite, 7,170–7,240 feet
Initial production: 41.18 bbls., 40° gravity oil in 3 hours through 30/64-inch choke on 2-inch tubing
Total depth: 7,256 feet in Ellenburger dolomite
Discovery method: Seismograph

JONES COUNTY

The Grogan pool, discovered by the Lewis Production Company's Grogan No. 1, in Cisco sand at 2,129–2,135 feet, with an initial production of 100 barrels daily on August 4, 1942, contributes the only new discovery for the county in 1942. One well has been drilled. The discovery well was drilled as the result of subsurface mapping.

SHACKELFORD COUNTY

Shackelford County had two discoveries in 1942. Roark's Elliot No. 1, in Strawn sand at 2,913–2,940 feet produced initially 50 barrels daily on January 29,

1942. Two oil wells and one dry hole have been drilled. The discovery was the result of seismograph exploration.

Kleiner *et al.* Dawson and Conway No. 1, in Cisco sand at 1,402–1,439 feet, produced initially 80 barrels daily on February 3, 1942. Two oil wells have been completed. The discovery well was drilled as the result of subsurface study.

An extension of the Nail pool was found by Roark's Nail No. 1, in Cisco sand at 1,506–1,521 feet, with an initial production of 53 barrels on June 29, 1942. Two oil wells have been completed as the result of this extension.

TAYLOR COUNTY

The first discovery in Taylor County in 1942 was Snoddy's Tipton No. 1, in what is known as the Trent pool. The discovery well was completed in a lower Cisco sand at 2,751 feet, with an initial production of 517 barrels per day on February 23, 1942. The well was drilled on subsurface information. Two oil wells and two dry holes have been drilled in the pool.

The only other discovery in the county in 1942 was Butler and Horn's Reddin No. 1, in the Reddin pool. The discovery well was completed on August 25, 1942, in a lower Cisco sand at 2,248–2,251 feet, with an initial production of 857 barrels per day. This well has the distinction of being the only discovery in the county which was found as the direct result of a geochemical survey. Four wells and three dry holes constitute the development in the pool to date.

ARCHER COUNTY

Archer County contributed two deep discoveries and three shallow discoveries during 1942.

Perry Browning's Fee No. 1, 330 feet from the south and east lines of Block 89, German Emigration Company Survey, might properly be located in the Votsberger pool in which this well found the Ellenburger limestone as a new producing formation at 5,201–5,288 feet. The well was completed, October 23, 1942, flowing 73 barrels of 41° gravity oil and 8 barrels of salt water in 3 hours.

George W. Cooper's Cordelia Knight No. 1, 330 feet from the north and east lines of the W. ½ of Block 69, K.W.V.L. (also S. P. R. R., Abst. 421), opened a new field, as well as a new producing formation for the district. The well was completed, August 7, 1942, flowing 131 barrels of 43.1° gravity oil through ¼-inch choke from a conglomerate formation at 4,886–4,926 feet at the base of the Pennsylvanian overlying the Barnett shale (Mississippian).

The W. E. Production Company's Ebnother No. 1, 1,200 feet from the north line and 330 feet from the east line of Block 102, John W. Harris Subdivision of the Club Ranch, opened a new shallow Thomas sand (Cisco) pool at 1,277–1,280 feet. The well was completed, May 1, 1942, pumping 86 barrels of 37° gravity oil.

W. R. Stafford's Richardson No. 2, 847 feet from the north line and 330 feet from the west line of the W. C. McCune Survey, Abst. 943, was completed on

July 30, 1942, pumping 169 barrels of 39° gravity oil and 41 barrels of salt water from the Swastika (Cisco) sand at 1,224–1,243 feet.

Grace and Grace's M. Wear No. 1, 330 feet from the south and west lines of Block 8, Crawford Pasture Subdivision of I. Holman Survey, was completed, November 27, 1942, pumping 9.9 barrels of 37° gravity oil from the Swastika (Cisco) sand at 1,273–1,282 feet.

WILBARGER COUNTY

The Potts-Ellenburger pool, the only discovery in Wilbarger County in 1942, is in the southeast part of the county, in Sec. 4, Block 7, H. & T. C. R. R. Company Survey, about 15 miles southwest of Electra and approximately 12 miles northwest of Kamay.

The discovery well, located on an anticline mapped by subsurface and seismograph, was drilled by the Consolidated Oil Company and was completed on February 20, 1942, with an initial flow of 155.82 barrels of 42° Bé., gravity oil in 3 hours. The elevation is 1,133 feet. The top of the Ellenburger was found at 4,532 feet. The total depth is 4,539 feet. This well encountered the K. M. A. limestone at 3,979 feet; Caddo limestone at 4,094 feet; Mississippian limestone at 4,493 feet.

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DEVELOPMENTS IN EAST TEXAS IN 1942[1]

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Tyler, Texas

ABSTRACT

Five new oil fields, one oil and gas field, and one gas field were discovered in East Texas in 1942 Three of these discoveries produce from the Woodbine formation, two from the Paluxy formation, and two from the lower Glen Rose formation. There was a decline of approximately 70 per cent in the number of wells drilled in producing areas. Important exploratory tests were directed to the Wilcox, Woodbine, Paluxy, lower Glen Rose, Travis Peak, and Smackover formations.

INTRODUCTION

There was a marked decrease in drilling activity in the East Texas area (Fig. 1) in 1942. The greatest decline was in producing areas, where the number of wells drilled was approximately 70 per cent less than the number drilled in 1941. The 411 wells drilled in 1942 as compared with those drilled the previous year are classified as follows.

	1941	*1942*
Oil wells	891	235
Gas and condensate wells	52	25
Dry holes (fields)	74	52
Dry holes (wildcats)	128	99
Total	1,145	411

NEW FIELDS

Bazette (*Navarro County*).—The Bazette gas field is approximately 2 miles southwest of the Bazette community in northeastern Navarro County. Production was established in this field on July 13, 1942, when Jon Hoosier's Mrs. Etta Black No. 1 was completed through casing perforations from 3,234 to 3,252 feet opposite the Woodbine formation. The initial production was 37 million cubic feet of dry gas per day on open-flow back-pressure test. This well is located on the Bazette fault structure, where test wells have been drilled at various times during the past 20 years. Some of these early wells had sufficient gas showings to encourage further drilling. Subsurface geological information afforded by the dry holes in the area indicates that the productive area of this field will be small. The Lone Star Gas Company is purchasing the gas from the producing well. A second well was being completed at the end of 1942.

Coke (*Wood County*).—The Coke field is near Coke in the northern part of Wood County, approximately 9 miles north of Quitman. The area was proved for production on June 10, 1942, when the Amerada Petroleum Corporation's C. B. Kennemer No. 1 flowed 320 barrels of 27½° gravity oil in 4 hours through open 2-inch tubing from casing perforations at 6,262–6,350 feet opposite the Pal-

[1] Published with permission of the Humble Oil and Refining Company. Presented by title before the Association at Fort Worth, April 7–9, 1943. Manuscript received, May 17, 1943.

[2] Trowbridge Sample Service, Owen Building.

[3] Humble Oil and Refining Company.

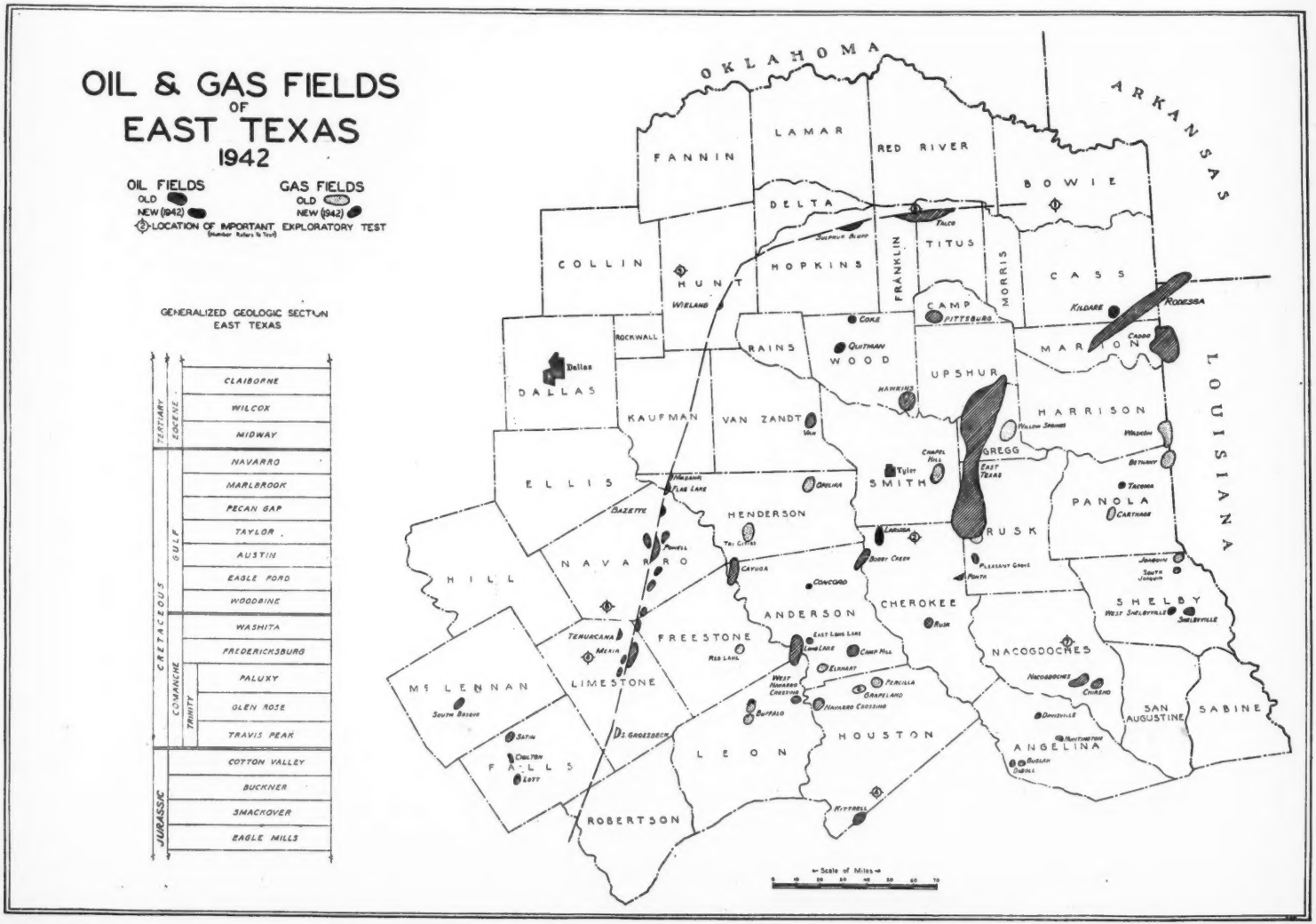

OIL & GAS FIELDS
OF
EAST TEXAS
1942
OIL FIELDS
OLD
NEW (1942)
GAS FIELDS
OLD
NEW (1942)
LOCATION OF IMPORTANT EXPLORATORY TEST
(Number Refers to Text)
GENERALIZED GEOLOGIC SECTION
EAST TEXAS
TERTIARY
EOCENE
CLAIBORNE
WILCOX
MIDWAY
CRETACEOUS
GULF
NAVARRO
MARLBROOK
PECAN GAP
TAYLOR
AUSTIN
EAGLE FORD
WOODBINE
COMANCHE
WASHITA
FREDERICKSBURG
TRINITY
PALUXY
GLEN ROSE
TRAVIS PEAK
JURASSIC
COTTON VALLEY
BUCKNER
SMACKOVER
EAGLE MILLS
OKLAHOMA
ARKANSAS
LOUISIANA
FANNIN
LAMAR
RED RIVER
BOWIE
DELTA
FRANKLIN
TITUS
MORRIS
CASS
COLLIN
HUNT
HOPKINS
CAMP
MARION
ROCKWALL
RAINS
WOOD
UPSHUR
DALLAS
KAUFMAN
VAN ZANDT
HARRISON
GREGG
ELLIS
SMITH
PANOLA
RUSK
HENDERSON
NAVARRO
HILL
ANDERSON
CHEROKEE
SHELBY
FREESTONE
NACOGDOCHES
MCLENNAN
LIMESTONE
SAN AUGUSTINE
SABINE
HOUSTON
ANGELINA
LEON
FALLS
ROBERTSON
Scale of Miles

FIG. 1

uxy formation. The oil was dark brown to black in color and had a mixed base. The gas-oil ratio was 107 to 1.

The structure is a slightly elongate dome with the producing area extending approximately 2 miles east and west and 1¾ miles north and south. It was a seismic and subsurface prospect.

At the end of the year 26 oil wells, all flowing, and 2 dry holes were drilled. The cumulative oil production was approximately 38,000 barrels. Most of the oil was transferred by truck to a tank-car loading rack at Winnsboro; a small amount was trucked to Hawkins.

Drill-stem tests of the sub-Clarksville sandstone in 2 wells recovered black asphaltic 18° gravity oil, but to date no attempt has been made to complete wells from this formation.

Concord (Anderson County).—The Concord field is approximately 9 miles north of Palestine near the Concord settlement in the northern part of Anderson County. Production in this area was obtained from the Woodbine formation, April 24, 1942, when the Magnolia Petroleum Company's W. C. Campbell No. 1 pumped 201.3 barrels of 12.2° gravity asphaltic oil in 24 hours from open hole at 4,520–4,540 feet.

The structure is a complexly faulted dome and was a seismic prospect. After the completion of the producer, 3 Woodbine dry holes were drilled in search of further production in the immediate area. The oil is used locally as road oil.

Kildare (Cass County).—The Kildare oil and gas field is in the southeastern part of Cass County, approximately 3 miles south of Kildare and approximately 2 miles north of the nearest production in the Rodessa field. John Messinger *et al.* Benefield and Singleton No. 1, the discovery well, was completed on March 7, 1942, in the Rodessa zone of the lower Glen Rose formation from perforations at 5,992–6,010 feet. The initial production was 185 barrels of 40.8° gravity oil in 20½ hours through ¼-inch tubing choke. The oil was dark greenish brown in color and had a paraffine base. The gas-oil ratio was 1,343 to 1.

The structure is a low-relief elliptical anticlinal dome. It was a geological and seismic prospect. At the end of the year 9 oil wells, 8 of which were flowing and 1 pumping, and 1 gas well were completed. The cumulative production was approximately 130,000 barrels. The oil is purchased by the Gulf Pipe Line Company.

Larissa (Cherokee County).—The Larissa field is approximately 5½ miles northwest of Mt. Selman, near the community of Larissa in the northwestern part of Cherokee County. This area was proved for production, September 15, 1942, when the Humble Oil and Refining Company's H. F. Curtis *et al.* No. 1 flowed 37.31 barrels of 48° gravity oil in 24 hours through ¼-inch choke from perforations at 10,160–10,212 feet in the uppermost Pettit porosity of the lower Glen Rose formation. The oil was amber in color and had a paraffine base. The gas-oil ratio was 1,811 to 1.

The structure is a large broad anticline with the major axis trending north and south. It was a surface geological prospect confirmed by seismic work. There was

no further development in the field at the close of 1942. The oil is purchased by the Pure Van Pipe Line Company.

Quitman (Wood County)—.The Quitman field is near the central part of Wood County approximately 3½ miles northwest of the town of Quitman. Production was established in this field, December 1, 1942, by Delta Drilling Company *et al.* when its J. B. Goldsmith No. 1 flowed 181.5 barrels of 43° gravity oil in 6 hours through casing perforations at 6,280–6,310 feet in the Paluxy formation. The oil had a brown color and a paraffine base. The gas-oil ratio was 316 to 1.

The structure is an anticline with the major axis trending northeast and southwest. It was originally a seismograph "high" which was proved by a dry hole to the Woodbine. The oil is transferred by truck to the Gulf Pipe Line Company's pumping station at Winnsboro.

Wieland (Hunt County).—The Wieland field is in the southeastern part of Hunt County, approximately 8½ miles southeast of the town of Greenville. The Hollandsworth Drilling Company *et al.* J. D. Baker No. 1, which was the discovery well of this field, was completed on June 27, 1942, flowing 266.12 barrels of 37.5° gravity oil in 24 hours through ¼-inch choke from casing perforations at 2,761–2,773 feet in the Woodbine formation. The oil had a dark brown color and a paraffine base. The gas-oil ratio was 50 to 1.

The field is on a fault structure which was located by surface geology and core drilling. The productive area is less than 1½ miles long and less than ½ mile wide.

On January 1, 1943, the field had 6 oil wells, 5 flowing and 1 pumping, and 10 dry holes. The cumulative production to that date was approximately 18,800 barrels. The oil was transported by truck to the Tidal Refining Company at Gainesville and the Gladewater Refining Company in Gladewater.

L. A. Grelling and D. F. Hugus drilled their Jenia Graham No. 1 to the total depth of 4,411 feet and tested the Paluxy formation, which yielded no showings.

FIELD DEVELOPMENTS

Caddo (Marion County).—In the Caddo field, 1 oil well was completed and 3 dry holes were drilled during 1942. With only 4 wells drilled during the year a marked decrease in drilling activity was experienced in this field from that of 1941, when 29 wells were drilled, 16 of which were oil wells.

Carthage (Panola County).—There was a slight increase in drilling activity in the Carthage field during 1942 when 5 gas-condensate wells were completed, as compared with 3 completions in 1941. Of the 5 wells completed during the year 2 were dual completions producing from the Rodessa and Pettit zones of the lower Glen Rose. The average daily condensate production on December 31, 1942, was 367 barrels.

Cayuga (Anderson, Henderson, and Freestone counties).—Routine development in the Cayuga field during 1942 resulted in the completion of 4 Woodbine oil wells. Two Woodbine oil wells were abandoned. At the end of the year there were 284 oil wells and 50 gas-condensate wells producing from the Woodbine and

6 gas-condensate wells producing from the Rodessa. Of the oil wells 127 were flowing, 146 were pumping, and 11 were dead.

On January 1, 1943, 7 recycling plants were in operation in this field. The average daily condensate production for the field was approximately 1,600 barrels. Cumulative oil production for the field was 26,389,000 barrels.

Chapel Hill (*Smith County*).—A marked increase in drilling activity in the Chapel Hill field in 1942 led to the completion of 28 oil wells and 2 gas-condensate wells. Of the oil wells 27 were completed in the Pettit and 1 in the Rodessa. Four of the Pettit wells are dual completions, which are producing oil from the Pettit and gas from the Paluxy.

On January 1, 1943, 41 oil wells and 5 gas-condensate wells were producing from the Pettit, which had yielded 669,000 barrels of oil and 211,000 barrels of condensate. On the same date 2 oil wells and 4 gas-condensate wells were producing from the Rodessa, which had yielded 10,800 barrels of oil and 639,000 barrels of condensate. Seven gas-condensate wells were producing from the Paluxy. Of the 7 Paluxy wells 5 are dual completions producing oil from the Pettit and gas from the Paluxy. The cumulative condensate production from the Paluxy was 298,800 barrels.

East Texas field.—Six oil wells were completed and 349 wells were abandoned during 1942 in the East Texas field. On January 1, 1943, the 25,458 producing wells in comparison with those at the beginning of 1942 are classified as follows.

	1941	*1942*
Flowing	17,330	16,905
Gas "kick-off"	100	95
Gas lift	979	979
Pumping	7,132	7,190
Dead	259	299

Fault-line fields.—During 1942 there was a marked decline in the drilling activity which was begun in 1941 in an attempt to obtain additional recovery from abandoned properties in the old Woodbine fault-line fields. During the year a total of 7 wells was drilled, including 3 oil wells and 1 dry hole in the Powell field and 1 oil well and 2 dry holes in the Wortham field.

Flag Lake (*Henderson and Navarro counties*).—During 1942, 3 oil wells and 1 dry hole were drilled in the Flag Lake field. Of the 3 oil wells, 1 originally produced gas but was later re-completed as an oil well. On January 1, 1943, the field had 20 producing oil wells, of which 2 were flowing and 18 were pumping. The cumulative oil production to that date was 737,500 barrels.

Grapeland (*Houston County*).—In the Grapeland field 2 gas-condensate wells were completed during 1942. At the end of the year the total completions for the field were 36 gas-condensate wells and 1 oil well. There were 4 recycling plants in operation. The average daily condensate production for the field was approximately 5,000 barrels. Cumulative condensate production was approximately 5,600,000 barrels.

Hawkins (*Wood County*).—In the Hawkins field 129 oil wells and 14 dry holes were completed in the Woodbine formation during 1942. At the end of the year the field had a total of 372 oil wells, of which 356 were flowing, 14 were pumping, and 2 were dead. In addition to these oil wells, 3 condensate wells were producing from the sub-Clarksville sandstone in the upper part of the Eagle Ford formation. On January 1, 1943, the cumulative oil production was 6,899,700 barrels, with an average daily production of approximately 27,500 barrels.

Joaquin (*Shelby County*).—In the Joaquin field 4 gas-condensate wells were completed in 1942. There was 1 recycling plant in operation in the field. The average daily condensate production for the field was 190 barrels.

Long Lake, including East Long Lake (*Anderson, Freestone, and Leon counties*).—There were 5 oil wells, 1 gas-condensate well and 1 dry hole completed in the Long Lake field during 1942. At the end of the year the field had 70 gas-condensate wells and 146 oil wells, of which 129 were flowing and 17 were pumping. There were 4 recycling plants in operation. The average daily condensate production was approximately 3,600 barrels. The cumulative oil production was 6,235,000 barrels.

Navarro Crossing (*Houston County*).—Only 1 gas-condensate well was completed in the Navarro Crossing field in 1942. On January 1, 1943, the field had 21 oil wells, of which 16 were flowing and 5 were pumping; also, the field had 7 gas-condensate wells, of which 6 were closed in. The cumulative oil production was 715,000 barrels, and the cumulative condensate production was 2,300 barrels. The average daily oil production was approximately 270 barrels.

Opelika (*Henderson County*).—There were 2 gas-condensate wells completed in the Opelika field during 1942. On January 1, 1943, the average daily condensate production was approximately 4,800 barrels, and the cumulative production was approximately 3,275,000 barrels. One recycling plant was in operation in the field.

Pittsburg (*Camp County*).—Two oil wells were completed in the Pittsburg field during 1942. At the end of the year the field had 5 oil wells, of which 2 were flowing and 3 were pumping. The cumulative oil production was 143,600 barrels.

Pleasant Grove (*Rusk County*).—During 1942, 3 Woodbine oil wells and 2 dry holes were completed in the Pleasant Grove field. One oil well was abandoned. On January 1, 1943, the field had 7 oil wells producing from the Woodbine, of which 4 were flowing and 3 were pumping. The average daily Woodbine oil production on the same date was 230 barrels and the cumulative Woodbine production for the field was 79,300 barrels.

Approximately 2 miles southwest of Woodbine production, O. W. Killam completed his E. B. Bass No. 1, February 24, 1942, through casing perforations from 2,910 to 2,965 feet opposite the Navarro chalk section. The well produced 212 barrels of net oil and 20 per cent salt water in 19¾ hours on the pump. The oil was 35.7° gravity and had a dark brown color. The gas-oil ratio was 200 to 1.

The well was originally drilled to 4,372 feet and after encountering salt water in the Woodbine formation was plugged back and completed as a producer in the

Navarro chalk section. During the year 3 other tests were drilled in the immediate area, but no showings were encountered in any of these tests.

Talco (Franklin and Titus counties).—In the Talco field, 3 oil wells and 1 dry hole were completed during 1942. On January 1, 1943, the field had a total of 751 oil wells, of which 14 were flowing, 722 were pumping, and 15 were dead. The average daily production for the field was 26,360 barrels and the cumulative production was 58,104,000 barrels.

During the year a test well was drilled to the Smackover limestone. This well was abandoned as a dry hole and condemned the Talco structure for Smackover production.

Van (Van Zandt County).—One Woodbine oil well and 1 shallow Nacatoch oil well were completed in the Van field during 1942. At the end of the year the field had 560 Woodbine oil wells and 4 sub-Clarksville oil wells, of which 303 were flowing, 257 pumping and 4 shut in. Two Woodbine gas wells were also shut in. The cumulative Woodbine and sub-Clarksville oil production as of January 1, 1943, was 132,300,000 barrels. On the same date there were 28 pumpers and 4 dead wells listed as oil producers from the Nacatoch which had yielded 335,000 barrels of oil.

Willow Springs (Gregg County).—One gas-condensate well was completed in the Willow Springs field during 1942. At the close of the year one recycling plant was in operation. The average daily condensate production for the field was approximately 580 barrels.

IMPORTANT EXPLORATORY TESTS

Bowie County.—In the northeast Bassett area in Bowie County the P. D. Bowlen *et al.* A. L. Simms No. 1 (*1*),[4] a Smackover project, was fishing for drill stem at the close of 1942 at the total depth of 8,609 feet in the upper part of the Buckner formation. This well was located on a fault structure which was outlined by seismic and geological work.

Cherokee County.—In the Mixon area in northern Cherokee County the Magnolia Petroleum Company's S. E. Braley No. 1 (*2*), was abandoned as a dry hole, October 26, 1942, in the Travis Peak formation at the total depth of 9,006 feet. The well was structurally high for the area and encountered a show of oil in the Woodbine formation but had no effective porosity in the deeper beds.

Franklin County.—The J. B. White *et al.* W. H. Jackson No. 1 (*3*), located on the Talco fault in northeastern Franklin County, was abandoned at the total depth of 9,084 feet in Eagle Mills salt. The upper part of the Smackover formation contained porous limestone with oil stains but yielded salt water when tested. This test was well located on the Talco fault and is considered to have condemned that structure for production from the Smackover formation.

[4] Italic numerals in parentheses refer to numbers in Figure 1 which indicate the locations of important exploratory tests drilled during 1942 and important active tests drilling at the close of the year.

Houston County.—In the Lovelady area of southern Houston County, the McCullough Tool Company's G. T. Lundy No. 1 (*4*) was drilled to the total depth of 5,016 feet in the Wilcox formation. This test was temporarily abandoned after pumping 14 barrels of 26° gravity oil and 70 barrels of salt water in 24 hours on February 24, 1942, from a thin sand in the Wilcox.

Hunt County.—In the Greenville area of Hunt County, the American Liberty Oil Company's J. P. McNatt No. 1 (*5*), was abandoned as a dry hole June 25, 1942, in Paleozoic rocks at the total depth of 6,896 feet. The test was a Smackover project and was located on the Preston anticline.

Limestone County.—In the south Coolidge area of Limestone County, The Texas Company's W. A. Keeling *et al.* No. 1 (*6*) was abandoned May 23, 1942, at the total depth of 6,018 feet after encountering Paleozoic rocks. The test apparently was an attempt to obtain production from a pinch-out of the Smackover limestone. No showings were reported.

Nacogdoches County.—The Texas Company's G. W. Strahan No. 1 (*7*), in the northeast Nacogdoches area of Nacogdoches County, was drilled to the total depth of 9,295 feet in the Travis Peak formation, and 5-inch casing was set at 9,054 feet. The Rodessa section of the lower Glen Rose tested salt water. A small amount of gas and condensate was obtained from perforations from 8,610 to 8,660 feet in the transition zone between the Pettit and Travis Peak. On December 31, 1942, preparations were being made to test deeper beds.

Navarro County.—In the Rodney area of Navarro County, the Falcon Oil Company's J. C. Keitt No. 1 (*8*) was abandoned, August 8, 1942, at the total depth of 6,455 feet after encountering Paleozoic rocks. This test was drilled on a geophysical prospect in search of Smackover limestone production. No showings were reported.

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DEVELOPMENTS IN OKLAHOMA IN 1942[1]

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ABSTRACT

Oklahoma produced 137,997,267 barrels of crude oil during 1942, or a loss of 14,016,675 barrels from 1941. This is 7,014,133 barrels short of the state allocation of 145,011,400 barrels based on the State Corporation Commission's estimate of demands for 1942. Declines were recorded in most of the important producing counties, but 88 per cent of the total decline occurred in the five leading counties which produced 55.9 per cent of the state total. The 14 million-barrel loss in production represents a 9.2 per cent decline which is considerably in excess of the national decline of 5.3 per cent. Oklahoma produced 9.9 per cent of the nation's crude oil in 1942, while in 1941 this rate was 10.8 per cent. This decline threatens Oklahoma's rating as the third producing state in the union.

New discoveries and extensions increased the estimated reserves of Oklahoma by 73,797,000 barrels, but this is offset by production of 137,997,267 barrels, or a net loss in estimated reserves of 64,200,000 barrels. Total estimated reserves as of December 31, 1942, are 968,927,000 barrels.

While production and reserves declined, exploratory work increased, particularly in the use of seismograph and stratigraphic tests. The increase from 281½ crew months of seismograph work in 1941 to 358 crew months in 1942 represents an increase of 27 per cent, while the number of stratigraphic holes increased from 23 to 44, or an increase of 91 per cent in the same time. Two methods of geophysical prospecting employed in 1941 were not reported in 1942.

There were 1,191 wells drilled, representing a decline of 45 per cent under 1941 when 2,162 wells were completed. Exploratory wells on the other hand declined only 7 per cent or from 271 exploratory wells in 1941 to 253 exploratory wells in 1942. This exploratory search yielded 75 successful operations of which 39 are classed as new pools, as against 81 successful operations with 41 new pools in 1941. The percentage of successful wells to the total exploratory wells is 29.6 in 1942 against 29.9 in 1941. The Pauls Valley pool was the most important discovery of the year.

New reserves must be discovered if Oklahoma is to maintain her status among the oil producing states. Present producing formations, chiefly Pennsylvanian and Ordovician sands, appear inadequate to supply the demand. The Arbuckle limestone produces in North Texas, in eastern Oklahoma, and in Kansas. It is one of the chief producing formations in the Oklahoma City pool, but with this exception it is practically untested in central Oklahoma.

INTRODUCTION

The total production of crude oil in the United States declined 5.3 per cent in 1942. In the five leading oil-producing states, each of which produced in excess of 100,000,000 barrels, three states recorded losses for 1942, while two states gained. Texas, with a 5.3 per cent loss, nearly equals in barrels of production the combined 7.8 per cent gain of California and the 9 per cent gain of Louisiana. Oklahoma production declined 9.2 per cent, while the largest decline of the five leading states occurred in Illinois, with a 17.3 per cent decrease.

Estimated national reserves[3] were increased by a half billion barrels, totalling 20,082,793,000 barrels, on December 31, 1942, against 19,589,296,000 barrels on December 31, 1941. Increases in reserves are listed in only eight states, with the rest of the 23 producing states registering decreases. Of the five leading producing states only two, Texas and Louisiana, increased their reserves; Texas alone was credited with an increase greater than the net national increase.

[1] Presented by title before the Association at Fort Worth, April 7–9, 1943. Manuscript received, March 8, 1943.

[2] Pure Oil Company.

[3] All figures for state and national reserves are based on the report of the American Petroleum Institute Committee on Reserves.

Oklahoma's reserves declined 64 million barrels, since production of 137,997,-267 barrels was offset by only 73,997,000 barrels of estimated new reserves added by new discoveries and extensions. While ranking third in production, Oklahoma ranks fourth in estimated reserves, with a total, December 31, 1942, of 968,927,-000 barrels.

Oklahoma produced 9.9 per cent of the nation's crude oil supply in 1942, as against 10.8 per cent in 1941. The number of wells drilled decreased from 2,162 in 1941 to 1,191 in 1942. In spite of this decline in the number of wells drilled, the rate of discovery of new pools was nearly maintained, there being 39 discovered in 1942, against 41 in 1941.

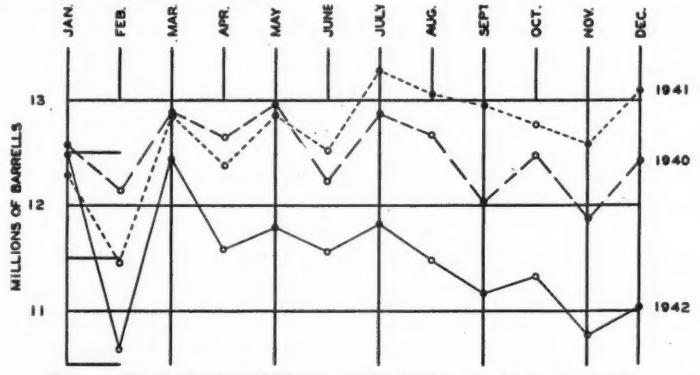


FIG. 1.—Graph showing Oklahoma production by months, 1940 to 1942.

The decline of production in Oklahoma, and the gain in Louisiana during the past year indicates that Louisiana may replace Oklahoma as the third ranking oil-producing state in 1943.

PRODUCTION

Oklahoma produced 137,997,267[4] barrels of crude oil during 1942 which is a decrease of 14 million barrels, or 9.2 per cent under the 1941 total of 152,013,942. The average daily production was 378,000 barrels against an average of 416,500 barrels in 1941. The decrease of 14,016,675 barrels under 1941 is the equivalent of shutting in every well in Oklahoma for 34 days. The decline was steady throughout the year as shown by Figure 1, which graphs the 1940, 1941, and 1942 production by months. Eighteen of Oklahoma's 42 oil-producing counties averaged more than 100,000 barrels per month. Declines were recorded in twelve of these counties. The five leading producing counties produced 77,138,234 barrels of oil or 55.9 per cent of the state's total. During 1941 these same five counties produced 58.9 per cent of the state's total, indicating a 3 per cent decrease. However, the actual decrease of production in these counties amounted to 12,286,511 barrels, or 88 per cent of the total decline of the state.

[4] All production figures for Oklahoma are taken from the Corporation Commission table of pipeline runs for 1942.

Table I lists the five ranking oil-producing counties and gives the comparative production and percentage figures for the last 3 years. Osage County, one of the oldest producing counties in the state, while registering a slight decline in barrels of production, actually increased its percentage of the state's total and has replaced Pottawatomie as the third ranking oil county.

TABLE I

COMPARATIVE PRODUCTION IN BARRELS OF FIVE LEADING COUNTIES

	1942		1941		1940	
	Production	*Percentage*	*Production*	*Percentage*	*Production*	*Percentage*
Oklahoma	27,629,133	20.0	33,450,191	22.0	37,476,542	25.0
Seminole	18,537,974	13.4	21,620,230	14.2	23,141,176	15.5
Osage	11,615,305	8.4	11,951,936	7.9	11,512,479	7.7
Pottawatomie	10,446,442	7.6	12,141,868	8.0	12,192,407	8.1
Carter	8,909,380	6.5	10,260,520	6.8	7,671,568	5.1
	77,138,234	55.9	89,424,745	58.9	91,994,172	61.4

The relation of Oklahoma production to national production is shown in Figure 2.

DRILLING OPERATIONS

Drilling operations were seriously curtailed during 1942 and there appears to be little encouragement for an increase in drilling during 1943. The total of 1,191 wells of all types drilled is a reduction of 45 per cent from the 2,162 wells drilled in 1941. That most of this reduction in drilling is the result of the 40-acre spacing ruling is evident from the fact that exploratory wells declined only 7 per cent, while pool wells declined 50 per cent. The urgent need for new oil will probably cause an increase in the number of exploratory wells in 1943, but the total number of wells drilled will not differ greatly from the 1942 record.

The deepest well completed during the year was the Amerada Petroleum Corporation's Sprague No. 1, Sec. 11, T. 8 N., R. 12 W., Caddo County, abandoned at 10,231 feet, in Pennsylvanian rocks. This is the ninth well in Oklahoma to reach or exceed 10,000 feet. The only other active 10,000-foot hole is the Denver Drilling Company's Sah Cam No. 1, Sec. 33, T. 10 N., R. 10 W., Caddo County, which at the total depth of 13,842 feet stuck drill pipe and has been fishing all year.

METHODS OF EXPLORATION

The total amount of exploratory work during 1942 was increased over 1941, but the methods used were more restricted. Six methods of exploration in 1941 worked 396 crew months (not counting core or stratigraphic tests), while three methods in 1942 worked 455 crew months. The bulk of the added exploration was done by seismograph which increased from 281½ crew months last year to 358 crew months this year. This trend is shown in the increase from 26 seismograph parties operating at the first of 1942 to 35 parties operating as the year closed. About 90 per cent of this work was done for the major oil companies.

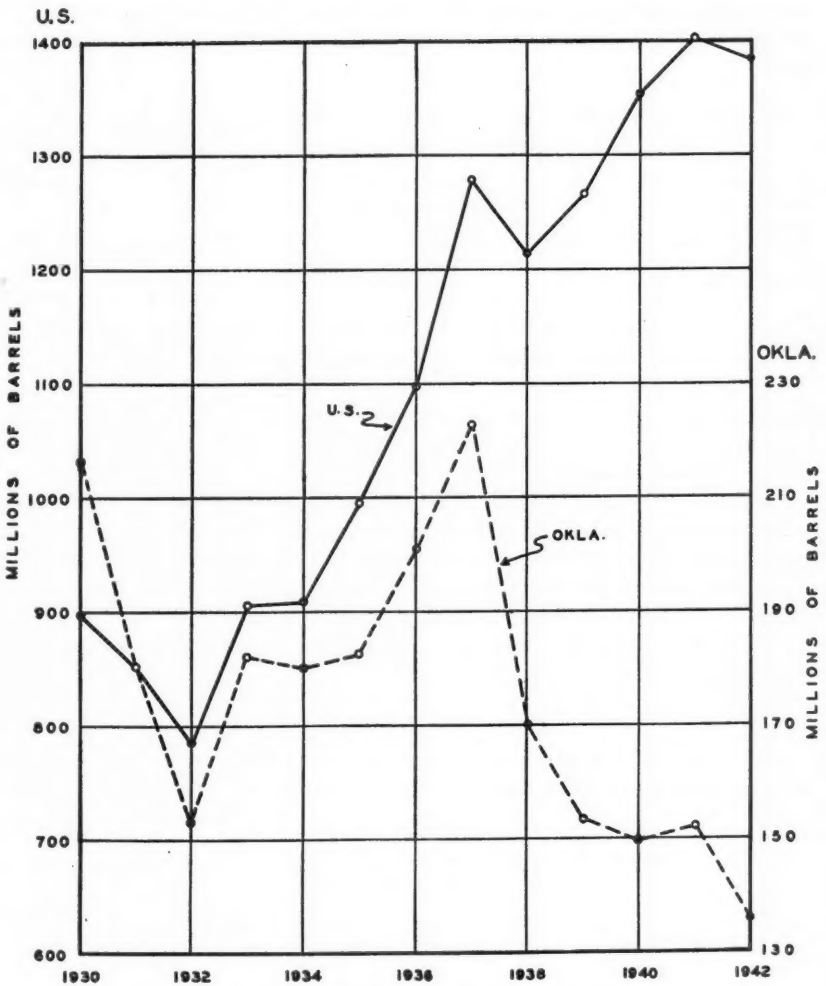


FIG. 2.—Graph showing relation of Oklahoma production to national production, 1930 to 1942.

The Anadarko basin was extensively worked early in the year, but the center of activity shifted to Garvin County after the discovery of the Pauls Valley pool. Cleveland and McClain counties have also been extensively worked. The general Seminole area continues to be worked and this work continues to produce new pools.

TABLE II

SUMMARY OF EXPLORATORY WORK DURING 1942 COMPARED WITH SIMILAR WORK IN 1941

	Amount of Work		*Number of Companies*	
Type	*1942*	*1941*	*1942*	*1941*
Seismograph	358	281½ crew months	17	25 approx.
Gravimeter	83	75½ crew months	12	10
Magnetometer	14	20½ crew months	4	3
Stratigraphic drill	44	23 holes	5	3
Core drill	105	227 holes	5	3
Surface work	4¾	7¾ crew months	3	3

The use of the gravimeter and magnetometer did not change much during the year. The gravimeter gained a little in popularity but still has no actual discovery credited to its use, while the magnetometer lost in crew months used. The combined use of these two instruments, however, is only one crew month more in 1942 than in 1941. Much of the work done, particularly by gravimeter, was in the Anadarko basin.

The use of stratigraphic drills increased materially during the past year, both in the number of holes drilled and in the total footage. Half of these tests were on the flank area between the Wichita Mountains and the Anadarko basin, and most of the rest were in the Cretaceous overlap south of the Arbuckle Mountains. Half of all the tests were drilled by one company.

While the number of stratigraphic tests increased nearly 100 per cent, the number of core holes declined sharply.

DISCOVERIES

The search for new oil in Oklahoma continues to be successful in spite of the decrease in production and reserves. The total number of wells drilled decreased

TABLE III

COMPARATIVE BREAK-DOWN OF WELLS DRILLED 1941 AND 1942

	Total	*Exploratory Wells*						*Pool Wells*
		Oil	*Gas*	*Dry*	*Ext.**	*N. Fm.**	*Total*	
1942	1,191	32	7	178	21	15	253	938
1941	2,162	39	2	190	13	27	271	1,891

* Some wells are both extensions and new producing formations, and this classification is rather arbitrary.

45 per cent, while the exploratory wells decreased less than 7 per cent. Table III gives a break-down of the wells drilled in 1942 compared with 1941. There were 75 successful exploratory operations (Table IV) or 29.6 per cent of the 253 exploratory tests drilled. This rate is nearly identical with 1941, when there were 81 successful out of 271 exploratory tests, or 29.9 per cent.

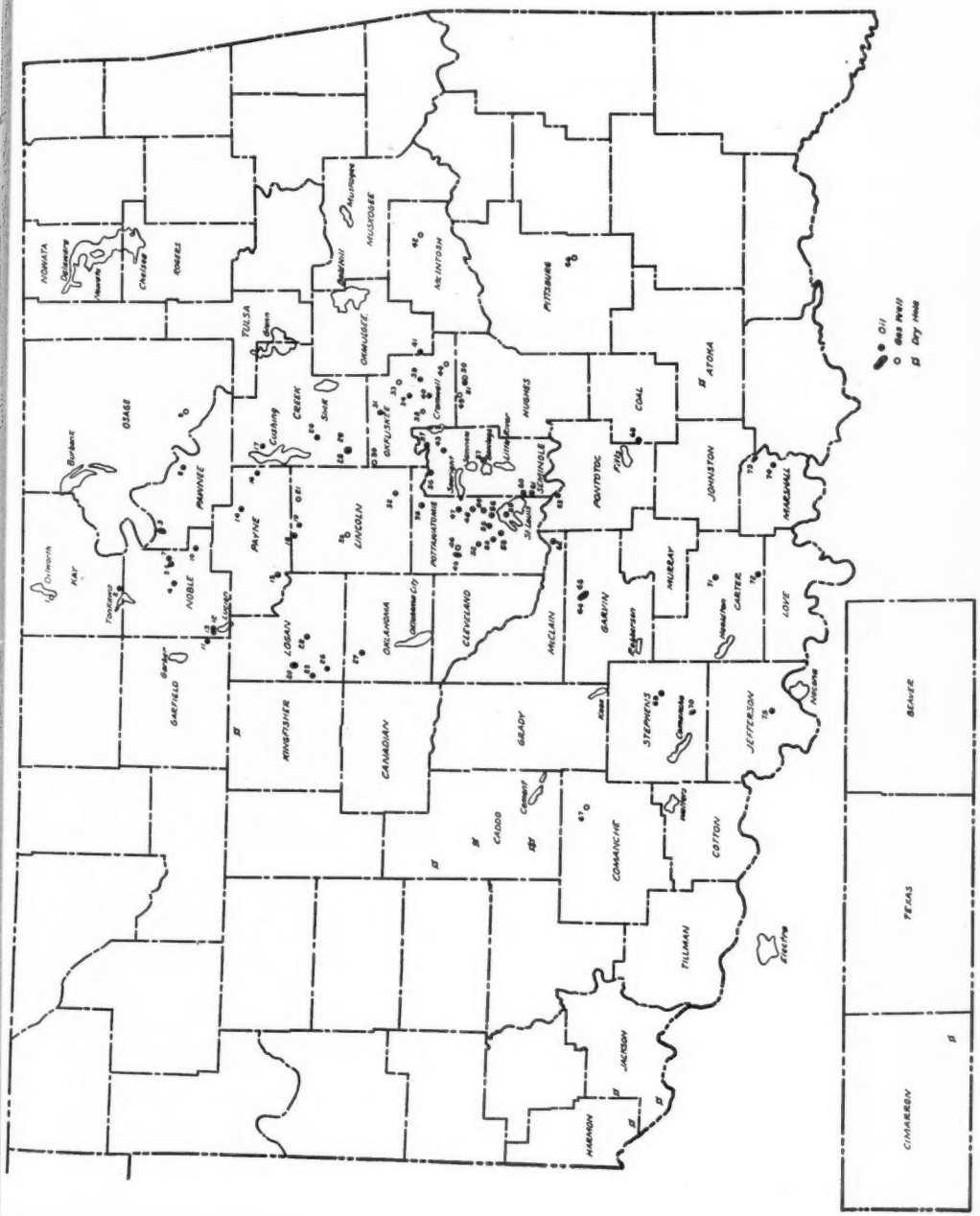


FIG. 3.—Map showing new pools, extensions, new producing formations, and important dry holes drilled in 1942.

TABLE IV

NEW POOLS—EXTENSIONS AND NEW PRODUCING FORMATIONS DISCOVERED IN 1942
(Index number refers to Figure 3)

Index No.	Location	County	Field	Class.	Operator	Farm	Date	Producing Formation	Depth (Feet)	Total Depth (Feet)	Depth Plugged Back (Feet)	Initial Production	Development
1	26-28-1W	Kay	Blackwell	Ext.	Adkins	Horinek	12-28	Shallow sand	992	3,673	1,100	1½ M. gas	1 gas
2	30-25-1E	Kay	—	New	Ingling & Parker	Stone	7-27	Layton	3,913	3,296		P. 25 oil—17 wtr.	1 oil
3	25-23-3E	Pawnee	E. Watchorn	New	Alma	Deroin	5-25	"Wilcox"	3,880?	3,891		Fl. 2528	15 oil—6 drlg.
4	16-22-1E	Noble	Otoe	N. Fm.	Meyer	Donahoe	12-2	Tonkawa	2,750	3,425	2,800	Fl. 30 oil	1 oil
5	9-22-2E	Noble	Liberty	New	Deep Rock	Schultz	6-29	2d "Wilcox"	4,515	4,765	4,552	Fl. 1160 oil—92 wtr.	3 oil—6 dry
6	9-22-2E	Noble	Liberty	N. Fm.	Sunray	Schultz	12-7	Layton	2,595	4,543	2,608	S-Fl. 340 oil—165 wtr.	1 oil
7	10-22-2E	Noble	E. Liberty	New	Deep Rock	Bailey	11-9	2d "Wilcox"	4,369	4,380		Fl. 1054	1 oil—1 drlg. 1 dry
8	26-22-6E	Pawnee	Skedee	Ext.	Whitney	Arnold	10-27	Prue	2,648	2,695		S.P. 35	1 oil
9	32-22-9E	Osage	—	New	Ohio-Osage	Osage	4-21	Bartlesville	2,190	2,208		21 M. gas	3 gas
10	7-21-3E	Noble	Morrison	New	Kubat	Tyer	12-21	Mississippian	4,024	4,356	4,090	A.P. 20	1 oil
11	36-21-3W	Garfield	N. Lucian	Ext.	Phillips	Lukenbaugh	2-23	"Wilcox"	5,423	5,568	5,475	Fl. 248	2 oil—2 dry
12	4-20-2W	Noble	NE. Lucian	New	Danciger	Province	6-18	2d "Wilcox"	5,390	5,397		Fl. 480	2 oil—5 dry
13	5-20-2W	Noble	NE. Lucian	N. Fm.	Danciger	Plumer	10-19	Misener-Viola	5,250	5,482	5,273	Fl. 55	1 oil
14	12-19-4E	Payne	—	New	Barry	Fee	8-10	Misener	3,797	3,825		Fl. 245	1 oil—1 dry
15	36-18-1E	Payne	N. Coyle	New	Portable Drlg.	Schoolland	6-1	Hunton	4,748	5,092	4,775	Fl. 19 oil—26 wtr.	2 oil
16	3-18-6E	Payne	Markham	N. Fm.	Okla. Gasoline Plant	S. Minnich	2-10	Burgess	3,241	3,248		Fl. 100	5 oil—1 dry
17	12-18-7E	Creek	Cushing	Ext.	J. E. Crosbie	Dailey	6-15	Skinner	2,648	2,672		S-P 25 oil—7 wtr.	4 oil—1 drlg. 1 dry
18	22-17-3E	Lincoln	E. Sporn	New	Haddock	Hert	2-2	Dolomite	4,530	4,555		A. 35	1 oil—1 dry
19	31-17-4E	Lincoln	W. Agra	Ext.	Danciger	Scott	10-5	Penn. sand	3,141	3,178		S-P 100	1 oil
20	27-17-4W	Logan	Crescent	Ext.	Continental	Ferguson	5-4	Layton	4,924	4,949		Fl. 834	15 oil—1 dr
21	32-17-5E	Lincoln	E. Agra	New	Mid-Continent	Bonebrake	12-28	Skinner	3,431	4,093		26½ M. gas	1 gas y
22	7-16-2W	Logan	Guthrie Townsite	New	Sunray	Welch	10-19	Dolomite and 1st "Wilcox"	5,597 5,649	5,759		Fl. 840	1 oil—2 drlg.
23	20-16-4W	Logan	S. Crescent	New	Gulf	Pulliam	7-20	Layton	5,224	7,505	5,259	S-P 58 oil—8 wtr.	1 oil
24	29-16-8E	Creek	Mercer	Ext.	Sinclair-Prairie	Bell	2-23	"Wilcox"	3,800	3,845	3,812	A-P 20	1 oil
25	10-15-4W	Logan	W. Navina	New	Cities Service	Babcock	2-9	Layton	5,010	6,800	5,115	Fl. 365 oil—8 hrs.	6 oil—2 dry
26	3-14-3E	Lincoln	Chandler	Ext.	Dunnett	Ashton	10-5	Oswego	4,020	5,103		5 M. gas	1 gas
27	30-14-3W	Oklahoma	Edmond	Ext.	Denver	Randolph	8-17	2d "Wilcox"	6,659	6,669		S-Fl. 314	1 oil—1 dry
28	2-14-7E	Creek	Hickory Grove	New	Malernee	Roundtree	2-9	Bartlesville	3,117	3,130		Fl. 228	10 oil—1 dry
29	11-14-7E	Creek	Hickory Grove	N. Fm.	Foundation	Taylor	10-5	Prue	2,624	2,663		Fl. 10	1 oil
30	7-13-7E	Okfuskee	—	New	Peters	Brown	3-2	Hunton	4,075	4,081		A. 17 M. gas	1 gas
31	21-13-9E	Okfuskee	—	New	Doak & Hughes	Hensley	5-11	Dutcher	3,180	3,204		S-P 17	1 oil—1 dry
32	10-12-5E	Lincoln	Wilzetta	N. Fm.	Amerada	Ladar "B"	6-8	Bartlesville	3,747	4,566	3,874	Fl. 121	3 oil
33	14-12-10E	Okfuskee	—	New	Summit	Ruck	4-13	Penn. sand	1,792	3,025	1,800	1½ M. gas	1 gas
34	31-12-10E	Okfuskee	N. Okemah	Ext.	British American	Dodson	4-20	Hunton	3,790	3,794		A-Fl. 45 oil—45 wtr.	1 oil
35	18-11-5E	Pottawatomie	N.E. Shawnee	New	Atlantic	Whistler	12-7	1st "Wilcox"	4,835	4,853		P. 285	1 oil
36	35-11-6E	Seminole	Keokuk	N. Fm.	Carter	Riddle	1-21	1st "Wilcox"	4,348	4,354		P. 300	1 oil
37	25-11-7E	Seminole	N.E. Sylvan	New	Shell	Norvell	6-2	Cromwell	3,654	4,485	3,691	A. Fl. 68 oil—68 wtr.	1 oil
38	21-11-9E	Okfuskee	W. Okemah	N. Fm.	Deep Rock	Heneha	1-26	Cromwell	3,446	4,023	3,480	6 M. gas	3 gas—1 dry
39	13-11-10E	Okufskee	N.W. Clearview	New	McBride	Replogle	6-2	Gilcrease	2,916	4,047		S-Fl. 68	1 oil

TABLE IV—*Continued*

Index No.	Location	County	Field	Class.	Operator	Farm	Date	Producing Formation	Depth (Feet)	Total Depth (Feet)	Depth Plugged Back (Feet)	Initial Production	Development
40	30-11-10E	Okfuskee	Midwest	N. Fm.	K.G.F.F.	Engelman	4-6	Hunton	3,646	3,895		Fl. 70 oil—170 wtr.	1 oil
41	7-11-12E	Okmulgee	Aztec	Ext.	Stekoll	Holmes 4-A	5-18	Deaner	2,273	2,279		Fl. 50	2 oil
42	16-11-17E	McIntosh	—	New	Phillips	S. Checotah	6-1	Atoka sand	1,503	2,992	1,538	4½ M. gas	1 gas
43	11-10-7E	Seminole	Sylvan	N. Fm.	Shell	Micco	6-2	Cromwell	3,538	4,428	3,603	Fl. 56 oil—6 wtr.	4 oil—1 dry
44	22-10-11E	Okfuskee	Weleetka	Ext.	Smith	Johnson	5-26	Gilcrease	2,406	2,410		4 M. gas	2 gas—1 dry
45	1-9-2E	Pottawatomie	Centerpoint	New	Sharp	Wells	4-1	Dolomite	5,620	5,866		A-S Fl. 218	4 oil
46	6-9-3E	Pottawatomie	Centerpoint	Ext.	Smith Bros.	Dawson	9-14	Earlsboro	4,835	5,687	4,958	5½ M. gas	1 gas
47	1-9-4E	Pottawatomie	N.W. Earlsboro	New	Crosbie & Atlantic	Turner	9-12	Earlsboro	3,845	4,574	3,870	P. 77 oil—22 wtr.	1 oil—1 drlg.
48	25-9-4E	Pottawatomie	Hotulke	N. Fm.	Amerada-Stanolind	Bowling	7-25	Dolomite	4,378	4,407	4,398	P-A Fl. 250 oil—60 wtr.	2 oil
49	6-9-10E	Hughes	Papoose	Ext.	Keener	Norton	1-19	Booch	2,580	3,874	2,610	S-4 M gas	1 gas
50	13-9-10E	Hughes	E. Wetumka	N. Fm.	Phillaine	City Wetumka	10-5	Wapanucka	3,120	4,000	3,280	23 M. gas	1 gas
51	14-9-10E	Hughes	E. Wetumka	N. Fm.	Bailey	Williams	9-28	"Wilcox"	3,928	3,962		S-P 35 oil—25 wtr.	1 oil
52	4-8-3E	Pottawatomie	Brooksville	New	Cities Service & Atlantic	Fort Cobb	3-24	Hunton	4,768	5,465	5,083	A.-Fl. 773—15 hrs.	4 oil
53	27-8-3E	Pottawatomie	Macomb	New	Atlantic	Hamil	7-13	Hunton	4,598	5,253		A.-Fl. 608—8 hrs.	2 oil—1 dry
54	12-8-4E	Pottawatomie	Maud	Ext.	Mid-Continent	Lovelace	8-24	Viola	4,303	4,455	4,385	A-P 80	2 oil
55	20-8-4E	Pottawatomie	—	New	Bucy	Reed	11-9	Hunton	4,411	4,866	4,471	A-P 16 oil—20 wtr.	1 oil
56	23-8-4E	Pottawatomie	N. St. Louis	New	Cities Service	Goodin	12-7	Viola	4,290	4,560	4,338	A-P & Fl. 80 oil—100 wtr.	1 oil
57	7-8-7E	Seminole	—	New	Kerlyn	Trapp	6-27	Dutcher	3,358	4,369		S-Fl. 10 oil—10 wtr.	1 oil—1 dry
58	1-7-3E	Pottawatomie	Romulus	New	J. F. Smith	DeGraff	7-27	Hunton	4,367	4,404		A-Fl. 607	1 oil—1 drlg.
59	11-7-4E	Pottawatomie	St. Louis	N. Fm.	Magnolia	Nona No. 3	5-16	2d "Wilcox"	4,262	4,270		P. 194	1 oil
60	2-6-5E	Seminole	N. Grayson	New	Hall	Stockton	11-9	Hunton	4,144	4,528		A-P 142	1 oil—1 drlg.
61	15-6-5E	Seminole	Grayson	Ext.	Palmer	Humphrey	2-16	Penn. sand	2,826	3,230	2,857	S-P 73	1 oil—2 dry
62	21-5-3E	McLain	Byars	Ext.	Roodhouse	Strawn	4-6	Viola	3,503	3,551		Fl. 270 oil—21 hrs.	2 oil—1 dry.
63	26-5-5E	Pontotoc	Roper	New	Delaney	Roper	11-9	Viola	2,460	2,552		A.-Fl. 425	3 oil—2 drlg. 1 dry
64	31-4-1E	Garvin	Pauls Valley	New	Pure	Teter	4-11	Bromide sand	3,900	4,044		Fl. 3246	12 oil—3 dry 2 drlg.
65	31-4-1E	Garvin	Pauls Valley	N. Fm.	Pure	Cashion-Teter	7-22	Basal Penn.	4,039	4,336	4,115	Fl. 228	3 oil
66	9-4-16E	Pittsburg	Hartshorne	New	Public Service	Choctaw & Chickasaw	1-5	Hartshorne	1,204	1,630	1,280	S. 2 M. gas	2 gas
67	5-3-10W	Comanche	—	New	Texas	Roll	9-20	Pontotoc	910	8,078	977	4 M. gas	1 gas
68	7-1-8E	Coal	Jesse	Ext.	Delaney	Gipson	10-19	Hunton	3,715	4,611		A. Fl. 60	1 oil
69	14-1S-5W	Stephens	N. Velma	New	Gulf	Spears	10-13	Penn. sand	1,878	2,425	1,971	S-P. 46	1 oil
70	35-2S-6W	Stephens	S. Woolsey	New	Fair Operating	Baker "B"	1-15	Arbuckle	1,771	1,805		Fl. 720	5 oil—3 dry
71	26-3S-1E	Carter	Caddo	Ext.	Pure	Fraser	10-21	Bromide	5,410	7,472	5,414	Fl. 1102	1 oil
72	24-5S-1E	Carter	Ardmore	New	Noble	Joliff	10-19	Springer sand	3,215	3,303		Fl. 349	2 oil—2 drlg.
73	20-5S-7E	Marshall	Cumberland	Ext.	Pure	Little 109-1	4-1	McLish	5,878	5,911		Fl. 2,496	9 oil—4 drlg.
74	13-6S-6E	Marshall	Aylesworth	New	Potts	Godfrey	10-12	Bromide	3,100	3,690	3,260	A.-P. 115	1 oil
75	14-6S-6W	Jefferson	Spring	Ext.	Seitz-Comegys	Barrett	1-26	Penn. sand	1,809	1,815		P. 28	2 oil—4 dry

Under "Class.": New = New pool; Ext. = Extension; N. Fm. = New producing formation.
Under "Initial Production": P = Pumped; Fl. = Flowed; A = Acidized; S = Shot; M = Millions of cubic feet of gas. Production figures in barrels unless otherwise indicated.

FINDING CHART FOR TABLE IV

Pennsylvanian
Tonkawa
Layton
Prue
Skinner
Earlsboro
Bartlesville
Hartshorne
Atoka
Gilcrease
Deaner
Dutcher
Wapanucka
Cromwell
Springer

Mississippian
Burgess, Mississippian, Misener

Siluro-Devonian
Hunton

Ordovician
Viola
Dolomite
"Wilcox"
2d "Wilcox"
Bromide
McLish

Most of the newly discovered pools are small and will have little effect on production or reserves. Many were one well pools with no offset wells drilling as the year ended, and it is doubtful if there will be additional development in some of these. A brief description of the more important discoveries follows.

EAST WATCHORN POOL

On March 18, 1942, the Alma Oil Company spudded Deroin No. 1, SW., NW., NW. Sec. 25, T. 23 N., R. 3 E. in northwestern Pawnee County, and 2½ miles northeast of the Watchorn pool. Showings of oil were encountered in Pennsylvanian sand, but the well was drilled directly to the Simpson, topped at 3,868 feet. "Pay" in the "Wilcox" was reported at 3,880–3,891 feet, total depth. Unfortunately, as no samples were taken of the producing sand, identification based on microscopic examination was impossible. The well flowed 2,528 barrels of 43° gravity oil in 24 hours through 7"-inch O.D. casing with 100 pounds casing pressure and 1,415 pounds bottom-hole pressure. Gas gauged 11,520,000 cubic feet daily.

Development has extended the pool into six sections, so far with no dry holes, and all production is from the same sand, now known to be "Wilcox." Showings of oil are common in Pennsylvanian sands, but to date these have not been tested. The Misener sand (Mississippian?) is represented in most of the wells by 2–5 feet of sand and chert, in which oil showings have been reported, but have not been tested. At the close of the year there were 15 completed wells, and 6 drilling wells. Most of the productive leases are held by the Alma Oil Company, with J. E. Crosbie, Inc., and the Wentz Oil Division both having edge production.

Location of the discovery well was made after a detail seismograph survey of the immediate area.

On December 28, the Alma interests, including all production in the East Watchorn pool, were bought out by the Phillips Petroleum Company and the Sunray Oil Company.

CRESCENT POOL (LAYTON)

After a lapse of about 5 years, the Crescent pool has been revived and extended on its eastern flank by the development of Layton sand (Pennsylvanian) oil. The last Simpson sand producer in the original pool was completed in July, 1937, after which there was no exploratory activity except a few plug-backs.

On May 4, 1942, the Continental Oil Company completed Ferguson No. 1, SW., SW., SE. Sec. 27, T. 17 N., R. 4 W., producing 834 barrels of 44° gravity oil from the Layton sand topped at 4,924 feet. The well is ½ mile east of the eastern limit of Simpson production and while it is credited with the opening of the extension it is not the first Layton producer in the area. In the fall of 1930, the Eason Oil Company drilled into the Layton sand in Katschor No. 1, in the SW., NE., SW. of Sec. 34, and this well was completed, producing 680 barrels with an estimated 4,000,000 cubic feet of gas. In spite of this good well, there was no further activity until April, 1933, when the Gypsy (Gulf) Oil Corporation and the Carter Oil Company started McConnell No. 1, in the center of the NE., SE.

Sec. 28, the discovery well, in Simpson sand. In March, 1934, the Sinclair Prairie Oil Company completed a well in the SW., SW., NE. Sec. 27 producing 25 barrels from the Layton after Simpson sands failed to produce. In May, 1939, the Gypsy (Gulf) plugged back an old Simpson well in the NW., NW., SW. Sec. 27 and perforated the Layton, producing a 44-barrel well. Little attention was paid to such wells because of the large potentials from the Simpson sand wells (seven wells had potentials of more than 25,000 barrels, three of these more than 50,000 barrels).

The discovery of such a good well by the Continental Oil Company early this year started a drilling campaign which has resulted in 15 producing wells and one dry hole. There are no delimiting dry holes on the east. The Layton discovery well has the highest potential to date.

HICKORY GROVE POOL

One of the few important pools developed in Pennsylvanian beds was opened by D. B. Malernee on February 9, when he completed the Roundtree No. 1, SW., NW., SW. Sec. 2, T. 14 N., R. 7 E. The pool is located between the Stroud and Deep Fork pools. The discovery well found Bartlesville sand at 3,117 feet and gauged 2,500,000 cubic feet of gas at 3,123 feet, and 11,300,000 cubic feet of gas at 3,127 feet, with a spray of oil. The oil increased as the well was deepened to 3,130 feet, total depth. The 5½-inch O.D. casing was run and cemented at 3,110 feet. When the cement plug was drilled, the well gauged 13,200,000 cubic feet of gas, with 4 barrels of oil per hour. The oil steadily increased and flowed 228 barrels oil in 24 hours with 13,200,000 cubic feet of gas through casing, when completed. The oil is 47° gravity.

Foundation Oil discovered a second pay sand on October 5, when it completed Taylor No. 1, center of the NW., NW. Sec. 11, T. 14 N., R. 7 E., in the Prue sand, producing 26 barrels of oil in 12 hours and 4,120,000 cubic feet of gas. The sand was reached at 2,624 feet and the well stopped at 2,663 feet, still in Pennsylvanian beds. Other wells in the pool have had oil and gas showings in the Prue.

At the close of the year there were 8 oil wells, 3 gas wells, and 2 dry holes, one of which was drilled in 1941. All of the wells produce gas, with 22,000,000 cubic feet the highest gauged. Three wells on the east edge of the pool produce only gas.

There is very little structure reflected by the Oswego (Fort Scott) limestone.

PAULS VALLEY POOL

Discovery of oil by The Pure Oil Company in the Pauls Valley area climaxed a 25-year search by major and independent operators in this area.[5] Because of its proximity to the Arbuckle Mountains, whose southwest flank has produced numerous oil fields, the area has been under almost constant inspection by the oil industry since about 1912.

Only the central portion of the once imposing northwest-southeast-trending

[5] The term Pauls Valley area as used here included only Ts. 2, 3, and 4 N., Rs. 1 W. and 1 and 2 E.

Arbuckle Mountains is now exposed, the ends of the anticline being covered by post-Arbuckle-orogeny deposition. Ordovician sands, which produce much oil in Oklahoma, crop out in the mountains, and oil seeps and asphaltic exposures are common in the mountain area. Pauls Valley is about 20 miles northwest of the mountains and on a westward-plunging arch extending from them. Since this arch is a continuation of the main Arbuckle Mountain fold it is probably severely folded and faulted, as are the exposed portions of the mountains. The possibility of finding buried Ordovician structures which were not too deeply truncated appeared to make this an ideal potential oil area.

As early as 1912 a well was drilled to 1,135 feet on the grounds of the Boys Industrial Home, about 3 miles south of Pauls Valley. Since 1917 there has been hardly a year without the completion of at least one well, all abandoned as dry holes. The first well to penetrate the full Pennsylvanian section and drill into the Arbuckle Mountain complex was the Black Petroleum Corporation's J. E. Gibson No. 1, NW., NE., NW. Sec. 29, T. 2 N., R. 2 E., about 8 miles southeast of Pauls Valley. This well, completed in 1924, at 3,008 feet, drilled from basal Pennsylvanian limestone conglomerate into Simpson sand at 2,215 feet, according to the drillers' log. A few small gas showings and some asphalt were encountered in Simpson sands, but for the most part these sands contained only sulphur water. Simpson formations have been tested in practically all of the wells drilled since the Black Petroleum Corporation's well and many encouraging showings of oil were encountered. Saturated Simpson sand was cored in several wells, but yielded salt and sulphur water with only a light showing of oil when tested. Shows of light oil and asphalt were found in the basal Pennsylvanian sands in many wells.

On March 21, 1942, The Pure Oil Company spudded M. A. Teter No. 1, its third wildcat test in the area. It is located in the SW., SW., NE. Sec. 31, T. 4 N., R. 1 E., in the bottom lands of the Washita River. Light oil showings were encountered in Pennsylvanian sands and a saturated core taken in the Bromide sand, topped at 3,900 feet, drew little attention from the oil industry. On the base of the Pennsylvanian and top of the Bromide limestone, the well was considerably lower than several dry holes in the area. However, a drill-stem test produced 42.6° gravity oil at the rate of 63 barrels per hour, with an estimated 3,500,000 cubic feet of gas and no water. The original completion depth was only 6 feet in the sand and later the well was deepened to 4,044 feet where an official potential of 130 barrels per hour through 2½-inch tubing with one-inch choke was established.

A half mile east of the discovery well in the SE., SW., NE. Sec. 31, the Pure's Cashion-Teter No. 1 failed to produce from Bromide sands and was plugged back to 4,115 feet where it was completed as a 228-barrel well from Pennsylvania sands and detrital material. Two other wells have since been completed as basal Pennsylvanian producers. There are two dry holes, one of which was drilled to

the Arbuckle limestone, on the southwest flank. Water was encountered on the northeast flank, in the Ohio Oil Company's and Texas Company's wells.

The trap is an elongate northwest-southeast anticline, with steep northeast and southwest flanks. Basal Missouri (Middle Pennsylvanian) shales and sandstones rest on Bromide limestones and in one well directly on Bromide sandstone, on the crest of the structure. Viola limestone has been encountered on the flanks. Present development indicates a productive closure of about 180 feet. The northwest and southeast limits of production have not been defined.

At the close of the year there were 15 producing wells, 2 drilling wells since completed as producers, and 3 dry holes. On the basis of 40-acre spacing there are 680 acres of proved territory. Most of the producing wells are on Pure Oil Company acreage, with The Texas Company, the Ohio Oil Company, and the Mid-Continent Oil Company each having edge wells on the north and northeast flanks of the pool.

Most of the major companies made geophysical surveys in the area. Location of the discovery well followed a seismograph survey by The Pure Oil Company.

SOUTH OF ARBUCKLE MOUNTAINS

The presence of several prominent surface structures along the south flank of the Arbuckle Mountains has been known since the days of the earliest geological work in Oklahoma. Portions of these structures,[6] which are reflected in Pennsylvanian deposits, are exposed, but for the most part they are buried beneath Cretaceous sediments. Production has been developed on some of these structures, but the more obvious surface structures have been shunned because of the steep dips exhibited, or at best have been inadequately tested. The past year has seen three of these structures successfully tested.

ARDMORE POOL, ON OVERBROOK ANTICLINE

The Ardmore pool was opened on October 28, 1942, when Lloyd Noble completed Jolliff No. 1, NE., NW., NW. Sec. 24, T. 5 S., R. 1 E. Location is 4 miles south of Ardmore, on the Overbrook anticline.

The Criner Hills, which lie chiefly within T. 5 S., R. 1 E., are paralleled by the Crinerville anticline on the southwestern flank and the Overbrook anticline on the northeastern flank, the latter structure extending several miles southeast, beyond the Criner Hills. Production was discovered on the Crinerville anticline in 1922 and the Crinerville[7] (now known as Brock) pool was developed on this structure, producing from sands of Pennsylvanian age. In 1926 the first test on the Overbrook anticline was drilled by Schermerhorn-Ardmore Company on the Jolliff farm. The well was located in the NE., NW., NW. Sec. 24, T. 5 S.,

[6] Charles E. Decker, "Structural Trends in Southern Oklahoma," *Oklahoma Geol. Survey Bull. 40*, Vol. 1, p. 74.

[7] Sidney Powers, "Crinerville Oil Field," *Structure of Typical American Oil Fields*, Vol. 1, p. 192.

R. 1 E., and was abandoned at 4,228 feet, because of a fishing job and collapsed casing. Most of the sands and many of the black shales contained oil, but the most encouraging showings were between 3,950 and 4,070 feet. An effort was made to test these sands but due to the collapsed pipe the hole was lost. In the spring of 1929 the Jolliff No. 2 was drilled 75 feet northwest of the original well. Here also oil and gas showings were found, particularly in sands between 3,790 and 4,130 feet. The hole was lost at 4,536 feet due to stuck drill pipe. There is a division of opinion among geologists as to whether this well stopped in Pennsylvanian shales or in the Sycamore. No further drilling on this part of the structure was done until Noble spudded his Jolliff No. 1, 100 feet east of the original Jolliff No. 1. Gas estimated at 10,000,000 cubic feet was encountered at 3,070 feet in sand topped at 2,990 feet. Cores through this sand showed dips as high as 65°. The well was completed at 3,303 feet where it flowed 349 barrels oil with a half million cubic feet gas from a sand topped at 3,210 feet.

A second producer, Tomlinson No. 1, was completed in the NE., SW., SW. Sec. 13, T. 5 S., R. 1 E., producing from a sand topped at 3,942 feet with 4,205 feet total depth. The well flowed 496 barrels of oil in 12 hours with an estimated 1,500,000 cubic feet of gas. A well in the NE., SE., SE. Sec. 14, completed since the first of the year, at 2,731 feet total depth, has been abandoned as a dry hole.

The producing zone is a sand in the Springer formation and it is thought to be the same sand in both the Jolliff and Tomlinson wells. This pool opens the first commercial production from Springer sands south of the Arbuckle Mountains and should point the way to additional search for such production in this area.

The structural trap is a very sharp elongate northwest-southeast-trending faulted anticline. Vertical to overturned dips are present in the limestones and sands on the surface in the immediate area. There is about 960 feet of northeast dip on the top of the producing sand zone between the Jolliff and Tomlinson wells. The structure is further complicated by the wedging-out of most of the Pennsylvanian section toward the Criner Hills.[8] The western limit of the Springer pay sands lies near the anticlinal axis.

CADDO POOL, ON CADDO ANTICLINE

The first production on this surface structure was obtained in August, 1939, when The Pure Oil Company completed Noble No. 1, Sec. 35, T. 3 S., R. 1 E. This well went 570 feet into the Arbuckle limestone, and was plugged back from a total depth of 8,500 feet to 4,454 feet, in the Woodford shale where it was completed for 96 barrels of oil. It has not been offset.

A second test on the same structure was made by the Pure's Fraser No. 1, SW., NE., SW. Sec. 26, T. 3 S., R. 1 E., a mile northwest of the Noble well. The Fraser well encountered oil and water in Bromide sands and was drilled on through the Simpson and went 512 feet into the Arbuckle. At the total depth of

[8] Personal communication from C. W. Tomlinson.

7,472 it was plugged back to 5,414 feet, where it was completed in October, producing 1,102 barrels of oil and 480 barrels of water from Bromide sand. Markers in the Fraser were about 875 feet higher than in the Noble well. Springer sands and shales at the surface stand nearly vertical.

Early in 1943 offsets to the Fraser well were staked by the Tide Water Oil Company and the Sun Oil Company. Both new locations are also in Sec. 26.

This discovery was the result of surface mapping followed by a seismograph survey.

AYLESWORTH POOL, ON MADILL ANTICLINE

Drilling on the Samedan's Godfrey No. 1, in Sec. 13, T. 6 S., R. 6 E., Marshall County, started in April and was carried to a total depth of 3,690 feet, in the McLish, without finding production, although numerous stains were encountered in various Simpson sands. Drill-stem tests covering some of these sands were unsuccessful. The most promising such test was from 3,106 to 3,183 feet, in the Tulip Creek sand, where 360 feet of oil and gas cut mud and 100,000 cubic feet of gas were obtained. A test from 3,670 to 3,690 feet, in the McLish sand yielded 90 feet of mud and 1,980 feet of salt water. At the completion of drilling an electrical survey was made and the well was shut down waiting for orders to abandon. About 2 months later the well was taken over by H. F. Potts to test upper beds. A string of casing was set at 3,090 and after testing lower sands the hole was plugged back to 3,260 feet, in upper McLish limestone. It was acidized twice, totaling 12,000 gallons, after which it produced about 5 barrels of oil per hour from Tulip Creek sand. It was then shot between 3,102 and 3,109 feet, in upper Tulip Creek sand, where it was completed, pumping as high as 115 barrels of oil and no water in 24 hours.

Similar efforts by Potts to make a producing well from an abandoned McLish sand test in Sec. 14 have not been successful.

Important Dry Holes

Gulf's Cox No. 1, Sec. 35, T. 2 N., R. 8 E., CM., Cimarron County, was the first well in the Panhandle to test the Simpson and Arbuckle. It was abandoned at 6,168 feet after drilling 168 feet into the Arbuckle limestone. Location was made after an extensive geophysical survey that included magnetometer, gravimeter, and seismograph.

Union Oil of California's Brown No. 1, Sec. 11, T. 19 N., R. 7 W., Kingfisher County, is one of the few Simpson sand tests west of the granite ridge in central Oklahoma. Total depth was 8,225 feet. No showings of oil or gas were encountered. This was a Shell seismograph play farmed out to Union.

Amerada's Smith No. 1, Sec. 14, T. 10 N., R. 13 W., Caddo County, abandoned at 8,000 feet in Pennsylvanian, was another attempt to locate a "high" in the Anadarko basin. It was located after a seismograph survey.

Amerada's Sprague No. 1, Sec. 11, T. 8 N., R. 12 W., Caddo County, also an

Anadarko basin seismograph play, was abandoned at 10,231, in Pennsylvanian shales and thin sands. Numerous oil stains were encountered. This is the only 10,000-foot hole completed in Oklahoma during 1942.

Texas' Noble Starr No. 1, Sec. 34, T. 6 N., R. 12 W., Caddo County, delimits the Apache pool on the northwest. Location was a half mile beyond production with the Bromide sand more than 300 feet lower than the closest producer. Water was encountered in the Bromide sand and the hole was abandoned at 4,376 feet, total depth. The Apache pool now has a dry hole at either end, but none on the flanks.

Texas' Oxley No. 1, Sec. 35, T. 6 N., R. 12 W., Caddo County, is a mile northeast of the crest of the Apache pool. This well drilled more than 3,000 feet of Mississippian Caney, cores of which revealed nearly vertical dip. The total depth is 4,967 feet, still in Caney, which is absent on the Apache structure. Location was made after a seismograph survey.

Logan's Leader No. 1, Sec. 2, T. 3 S., R. 10 E., Atoka County, was spudded as a 3,800-foot Simpson sand test, but was abandoned at 6,561 feet after reaching the Wapanucka limestone at 6,455 feet. While it spudded in the Cretaceous, it is less than 10 miles from granite exposed in the east end of the Arbuckle Mountains. This is a subsurface play.

In addition to the foregoing tests, there have been three 7,500-foot dry holes drilled in Harmon and Jackson counties, southwest of the Wichita Mountains. All were drilled as the result of geophysical surveys and all were abandoned without reaching the base of the Pennsylvanian.

Noble's Mayrhofen No. 1, Sec. 32, T. 2 N., R. 23 W., Jackson County, was a Stanolind farm-out drilled to 7,503 feet, where it was abandoned in the Bend. Seismograph and gravimeter surveys were made before location of the well.

Gulf's Chaffin No. 1, Sec. 25, T. 1 N., R. 25 W., Harmon County, was drilled to 7,523 feet and was abandoned in basal Strawn or upper Bend. Location followed seismograph survey.

Samedan's Gregory No. 1, Sec. 36, T. 1 S., R. 24 W., Jackson County, a Stanolind farm-out, was abandoned in Bend at 7,504 feet. Location was made after seismograph and gravimeter survey. Ten miles south of this well, in Hardeman County, Texas, the Amerada's Rice No. 1 drilled into the Arbuckle (Ellenburger) limestone at 8,000 feet.

Conclusion

The present rate of discovery of oil in Oklahoma might be adequate in normal times, but with the added demands for petroleum products caused by the war it is now inadequate. A reduction during 1942 in production and the number of wells drilled was to be expected, but in both cases this decline has exceeded the national rate by an amount which should cause concern among Oklahoma geologists and oil producers. From the standpoint of the future the failure to increase or even to maintain estimated reserves is more important than the decline in production. The maintenance of the discovery rate of new pools offers a little

encouragement and there is evidence to indicate this discovery rate may increase in 1943, but most of the pools found in recent years are small and it is doubtful if such discoveries will bolster the state production in the manner needed.

The discovery of a new producing formation or a new oil province in Oklahoma would best solve the present problem. The discovery of a new oil area, such as Seminole, is not impossible, but appears at least improbable during 1943. The discovery of a new producing formation, on the other hand, appears much more feasible. The Arbuckle limestone is known to be present, with the exception of a few granite hills and deeply truncated anticlines, throughout the state. This limestone is the chief producing formation on the Central Kansas uplift. It produces in several pools in northern Texas. The Oklahoma City pool has produced great quantities of oil from it and numerous pools in the Tulsa area produce Arbuckle oil. In spite of this fact, the Arbuckle limestone is practically untested in central Oklahoma. In the entire Seminole area there are three Arbuckle tests. The discovery of Arbuckle oil in this area alone would solve all Oklahoma's oil problems for several years, if Arbuckle production at Oklahoma City is any criterion.

The search in 1943 and future years must be not alone for new pools, but for new, and probably deeper, formations in the old producing areas. The old adage that it is useless to test sands below the "Second Wilcox" sand must be abandoned or at least subjected to test by an adequate number of correctly located deep holes. Lacking some such campaign, Oklahoma seems destined to decline in importance as an oil-producing state.

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DEVELOPMENTS IN NORTH MID-CONTINENT IN 1942[1]

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ABSTRACT

Kansas produced 98,907,986 barrels of oil in 1942, more than 15,000,000 more than in the previous year and the largest amount in any year. Production early in 1943 was running close to 300,000 barrels per day which is almost equal to the pipe-line capacity in the state.

There were few important oil discoveries in Kansas in 1942, although there were many extensions of old pools. None of the discoveries in 1941 was developed into a major field. Although the number of wildcats increased, the general class of prospects was poorer than in previous years. Geophysical prospects were especially disappointing. Due to the increased wildcatting and the wider spacing, the dry-hole percentage increased to 40.7 per cent, compared with 26.9 per cent in 1941. The number of wells drilled fell from 1,818 to 1,353. This is due in part to the shortage of equipment, but chiefly to the introduction of 40-acre spacing. Daily allowables per well continued to increase and some prolific fields were being produced at a rate that approached the limits of good production practice.

The first deep production in the Forest City basin in Missouri was found by a small well in Atchison County. There were no other encouraging developments in Missouri or Iowa. No new pools were found in Nebraska, although wildcat drilling yielded much valuable stratigraphic information. The old pools appear to be completely drilled. The cumulative production to the end of 1942 was approximately 3,430,000 barrels.

KANSAS

DRILLING ACTIVITY

Drilling activity in Kansas for the last 3 years is summarized in Table I.

TABLE I

	1942	*Percentage*	*1941*	*Percentage*	*1940*	*Percentage*
Oil wells	713	52.7	1,253	68.9	1,421	76.4
Gas wells	89	6.6	75	4.2	61	3.3
Dry holes	551	40.7	490	26.9	377	20.3
	1,353		1,818		1,859	

The figures for 1942 do not include recompleted wells. In this classification there were 65 oil wells with a potential of 41,270 barrels, 8 gas wells with a capacity 110,336,000 cubic feet, and 45 dry holes.

The introduction of 40-acre spacing caused much of the increase in the percentage of dry holes from 26.9 per cent to 40.7 per cent. A contributing factor was that a greater proportion of the wells drilled were wildcat.

TABLE II

Year	*Oil Wells*	*Barrels Potential*	*Barrels Average Potential*	*Gas Wells*	*Capacity in 1,000 Cubic Feet*	*Average Capacity in 1,000 Cubic Feet*
1939	983	1,548,772	1,577	62	1,280,984,000	20,661,000
1940	1,421	2,218,720	1,561	61	1,292,201,000	21,183,000
1941	1,253	1,727,593	1,379	75	797,011,000	10,626,000
1942	713	788,139	1,106	89	610,769,000	6,862,572

The decline in the production of new wells in 1942 compared with previous years continues the trend established in 1941. Few prolific fields have been discovered in Kansas in recent years, although there have been many important extensions. Moreover, there has been a disposition on the part of some operators

[1] Presented by title before the Association at Fort Worth, April 7–9, 1943. Manuscript received, April 20, 1943.

[2] Darby Petroleum Corporation.

to take relatively small potentials on their wells in order to more accurately determine the true capacity of the well. In some cases, physical tests have been taken rather than draw down potentials. This has had the effect of reducing allowables to some extent.

As the older fields decline in production, many of them have been removed from the prorated class. The total potential of the state decreased from 8,119,298 barrels at the end of 1941 to 7,664,404 barrels at the end of 1942 and had further decreased to 7,040,203 barrels in April, 1943.

LEASING ACTIVITY

The most widespread leasing activity during the year occurred in the Salina basin as a result of development of the Lindsborg and Roxbury pools. A large amount of land in McPherson and Saline counties was leased during the year. The development of the Iuka pool in Pratt County and the Peace Creek trend in Reno County encouraged leasing activity in these counties. Many checkerboard leases and several blocks were added on the southwest flank of the Central Kansas uplift, principally in Pawnee, Edwards, and Rush counties. Numerous small blocks and pieces of checkerboard leases were taken in Decatur, Thomas, Logan and Phillips counties, but very little development occurred in this western area.

PRODUCTION

Kansas reached another new high record in crude oil production in 1942 when 98,907,986 barrels were produced, compared with 83,229,159 in 1941. This increased production was filled by greater withdrawals from pools which had been rigidly prorated since their discovery. In some areas, due to the peculiarities of proration, some wells were produced at rates that approached or exceeded the limits of good production practice. In a few areas of flush production, this resulted in the encroachment of salt water. At the end of the year, some Kansas operators petitioned the Corporation Commission for a reduction in allowables in order to prevent water encroachment. In an attempt to take the load off the major fields which were being produced at a too rapid rate, the minimum allowable per well was raised from 15 barrels per day to 20 barrels per day and, effective April 1, 1943, to 25 barrels per day. In this manner, moderate-sized wells in pools of large average well classification, are allowed to contribute more to the total production of the state.

The average daily allowable in barrels per prorated well during the past 2 years fluctuated as shown in Table III.

The pipeline capacity of Kansas at the end of 1942 was estimated at between 315,000 and 325,000 barrels. There is little likelihood of any substantial increase of this figure in the immediate future.

WILDCATTING

Wildcat drilling increased about 40 per cent over 1941. It would seem that with the increase of this nature, important additional reserves would be found; however, such was not the case due to several reasons. One of these is the fact

TABLE III

	1941	1942		1941	1942
January	22.4	27.7	July	26.8	31.7
February	22.1	26.6	August	28.1	30.8
March	22.8	26.1	September	27.7	32.5
April	24.0	26.7	October	28.7	33.6
May	24.9	26.2	November	28.2	34.4
June	26.5	29.6	December	28.6	35.2

that most of the wildcatting was done in an attempt to find extensions of old pools on the Central Kansas uplift. A very small proportion of the wildcat tests drilled were located in counties that are non-productive of oil. Moreover, there was an increase in the number of wells drilled without benefit of scientific background; in fact, 37 per cent of the 1942 wildcat wells were drilled without geological or geophysical basis. Naturally these wells were not responsible for the discovery of any large reserves of petroleum.

TABLE IV

	Producing	*Dry*	*Total*
Non-geological			
Chance	4	118	122
Geological			
Subsurface	15	45	60
Core drill	4	39	43
Surface	3	23	26
Seismograph	5	54	59
Seismograph and subsurface	0	1	1
Seismograph and core drill	0	7	7
Seismograph and surface	1	4	5
Seismograph, surface, and subsurface	1	1	2
Surface and subsurface	0	1	1
Magnetics	0	2	2
Core drill and subsurface	1	4	5
	34	299	333

No attempt is made to estimate the amount of new reserves discovered in 1942 by wildcat drilling except to state that Kansas apparently produced twice as much oil as was found.

The declining rate in discoveries in Kansas is due in part also to the fact that several of the normally active major companies have done little exploratory drilling in the past several years. A large proportion of the company-drilled wildcat tests were drilled by four companies, whereas several of the major companies drilled no wells during the year. It is natural that, under these circumstances, the dry-hole percentage should increase.

A study of Table IV shows the increasing importance of subsurface methods of discovering new production and the unusually poor record made by geophysical methods. One explanation of the latter phenomenon is the lack of coördination of geophysical and geological information; another is poor records, while another is that certain parts of the state are not adaptable to this type of exploration. Part of the poor showing made by the core drill may be explained by the fact that in some cases the test drilled was the second or third test of a core-drill anomaly. In some cases, "bootleg" core-drill information was the only excuse for drilling the well.

Table V shows a comparison of wildcatting in 1938, 1939, 1940, 1941, and 1942.

TABLE V

Year	*Oil and Gas Wells*	*Total Feet*	*Dry Holes*	*Total Feet*	*Total Wells*	*Total Feet*
1938	43	148,050	129	478,389	172	626,439
1939	21	67,259	74	258,031	95	325,290
1940	23	75,142	122	408,887	145	484,020
1941	37	140,284	200	688,189	237	828,473
1942	34	122,041	299	1,039,753	333	1,161,794

The average discovery well in 1942 had a depth of 3,589 feet compared with 3,791 feet in 1941. The average dry hole in 1942 was drilled 3,477 feet compared with 3,440 feet in 1941. The deepest wildcat was drilled to 6,525 feet; only thirteen reached below 5,000 feet and only sixty-six exceeded 4,000 feet.

NEW POOLS

Table VI lists the new pools discovered in western and northeastern Kansas in 1942 as named by the nomenclature committee of the Kansas Geological Society. Most of the pools are either extensions of old pools or are of minor importance. In Pratt County, the discovery of the Iuka East pool which is now part of the Iuka pool added a more prolific portion of this Simpson sand and dolomite producing area. Irregular sand conditions account for several inside dry holes and small wells. Northeast of this area, the Carmi pool was discovered by the Hollow Drilling Company in Sec. 29, T. 26 S., R. 12 W., by a well which established a maximum potential from the Arbuckle dolomite. Considerable development is being carried on and a pool of more than average importance is in prospect.

In Rice County the Smyres pool in T. 19 S., R. 6 W., is a short distance north of the Bornholdt pool and has resulted in production similar in size to that pool. About 20 wells have been found in this area at the close of the year. The producing formation is the chat at the top of the "Mississippi lime." The discovery of the Lindsborg South and the Lindsborg Southwest pools is a natural development extending the so-called "Viola limestone" production of the Lindsborg pool which underwent additional development during the year. Although recoveries in this area are not expected to be high, additional interest was developed by the completion of several wells on the east side of the structure produced from sands of Simpson age. It is expected that the Simpson sand production will be restricted to a very small part of the field.

One of the most important developments on the Central Kansas uplift during the year was the discovery of the Berry pool by the Continental Oil Company in Sec. 11, T. 9 S., R. 19 W. Prolific Arbuckle dolomite production was found in this area and gives promise of developing into the first really prolific production for Rooks County.

Late in 1942, the discovery of the Ellis pool in Ellis County focused attention on a part of the state which heretofore had not shown promising results from a production standpoint. Additional development during 1943 will determine the worth of this discovery and will probably be an important factor in the estimation of the value of western Ellis and eastern Trego counties.

TABLE VI

WESTERN KANSAS POOLS, 1942

Field	*County*	*Sec.-T.-R.*	*Total Depth (Feet)*	*Producing Formation*	*Method of Exploration*	*Potential*
Barry	Rooks	11- 9-19W	3,546	Arbuckle	Core drill	3,000
Baum	Rooks	10-10-16W	3,689	Lans.-K.C.	Chance	210
Bear Creek	Barber	30-31-15W	5,305	Douglas sand	Surface	85
Beaver, N.W.	Barton	6-16-12W	3,332	Lans.-K.C.	Subsurface	408
Belpre	Edwards	8-25-16W	4,650	Lans.-K.C.	Seismograph	25,000,000 gas
Boyd	Barton	33-17-14W	3,451	Arbuckle	Surface & seismo.	45
Breford, S.W.	Barton	23-17-11W	3,328	Arbuckle	Subsurface	307
Carmi	Pratt	29-26-12W	4,297	Arbuckle	Core drill	3,000
Crowther	McPherson	26-17- 1W	3,422	"Miss. lime"	Core drill & subsurf.	151
Curtis	Stafford	6-22-13W	3,700	Arbuckle	Subsurface	3,000
Deerhead	Barber	26-32-15W	5,313	Viola	Surface	14,000,000 gas
Dorr	Rooks	20- 9-16W	3,504	Lans.-K.C.	Seismograph	141
Ellis	Ellis	31-12-20W	3,847	Arbuckle	Seismograph	337
Harrison	Barton	18-20-13W	3,528	Arbuckle	Chance	80
Hazel	Stafford	21-21-13W	3,703	Arbuckle	Chance	2,400
Heiken, N.	Ellsworth	24-17-10W	3,228	Arbuckle	Subsurface	231
Iuka East	Pratt	6-27-12W	4,254	Simpson	Core drill	684
Jerry	Russell	4-15-14W	2,991	Lans.-K.C.	Subsurface	463
Kraus, N.W.	Ellis	17-14-19W	3,805	Basal sand	Surf., subsurf. & seismo.	49*
Lindsborg, S.	McPherson	19-17- 3W	3,363	Maquoketa dol.	Subsurface	891
Lindsborg, S.W.	McPherson	25-17- 4W	3,615	Maquoketa dol.	Subsurface	3,000
Merton	Barton	10-19-15W	3,578	Basal sand	Subsurface	168
Morton	Reno	17-24- 8W	3,910	Lans.-K.C.	Seismograph	185
Mue-tam	Barton	35-20-11W	3,335	Arbuckle	Subsurface	403
Peace Creek, S.W.	Reno	32-23-10W	3,740	Viola	Subsurface	1,106
Pioneer	Rice	25-19-10W	3,290	Arbuckle	Subsurface	567
Roxbury, S.	McPherson	30-17- 1W	2,670	"Miss. lime"	Core drill	3,000
Russell, N.	Russell	15-13-14W	3,254	Lans.-K.C.	Subsurface	430
Smyres	Rice	35-19- 6W	3,354	"Miss. lime"	Subsurface	3,000
Stucky	Harvey	3-23- 3W	3,277	"Miss. lime"	Subsurface	2,000,000 gas
Wilkins, S.E.	Ellsworth	32-17- 9W	3,233	Arbuckle	Subsurface	3,000
Witt	Russell	3-14-14W	3,011	Lans.-K.C.	Chance	429
Zook	Pawnee	16-23-16W	4,150	Arbuckle	Seismograph	100
			120,673			
EASTERN KANSAS POOLS						
Ackerland	Jefferson	1-10-20E	1,368	McLouth sand	Surface	5,800,000 gas

* Temporary potential.

Very few encouraging results were found in the southwestern part of the state as the result of the further drilling around the Patterson discovery well in Sec. 23, T. 22 S., R. 38 W., Kearny County. A total of three oil wells and two dry holes have been drilled to test the producing formation, a sand in the lower part of the Cherokee of Pennsylvanian age. The disappointing results of some near-by wildcat tests have definitely slowed development in this area.

The most active area in the state was on the Peace Creek-Zenith trend in which a half dozen separate discoveries have been joined into one producing area. The producing horizons are the Viola limestone, Misener sand, and the Maquoketa dolomite and profitable production is secured. At the end of the year, how-

ever, the limits of the Peace Creek pool apparently had been found and drilling on 40-acre locations has nearly ceased.

Many of the older fields continue to have additional development. This is true of the Bemis, Trapp, Kraft-Prusa, Chase, Silica, and Hall-Gurney areas; although the initial production of wells in these fields is not as high as in previous years, important reserves are being drilled.

IOWA

TABLE VII

County	*S.-T.-R.*	*Operator*	*Total Depth (Feet)*	*Formation*	*Method*
Fremont	19-68-40W	Ohio Oil No. 2	*	*	Core drill
Montgomery	15-72-38W	Ohio Oil No. 1	*	*	Core drill
Guthrie	11-78-30W	Fletcher & Hunt	*	St. Peter ss.?	Chance

* Tight holes or stratigraphic tests on which information is unavailable or of doubtful value.

Information is not available on the three deep wildcat tests completed in Iowa in 1942. Two of these were stratigraphic tests and one was a tight hole drilled by independents. The location of these wells is shown in Table VII.

MISSOURI

The Cities Service Oil Company completed the first deep producer in the Forest City basin when its Cook No. 1 in the NW. corner, Sec. 32, T. 65 N., R. 39 W., Atchison County, produced 16 barrels of oil and 335 barrels of water from a sand in the Cherokee shale, at a depth of 1,447 feet. The gravity of the oil was 28°. This well is important only in demonstrating that other production in this part of the basin may be expected. It is important to note that few encouraging shows of oil have been found in pre-Pennsylvanian beds in Missouri. Other exploratory tests in the state consisted of stratigraphic tests and additional wildcat wells which failed to give any encouraging results for deep production.

TABLE VIII

County	*S.-T.-R.*	*Operator*	*Total Depth (Feet)*	*Formation*	*Method*
Clinton	21-57-30W	Ohio Oil No. 1	*	*	Surface & Core drill
Clinton	26-57-30W	Ohio Oil No. 2	*	*	Surface & Core drill
Andrew	18-58-33W	Ohio Oil No. 3	*2,377?	Arbuckle?	Core drill
Holt	32-60-37W	F. C. Miller	3,513	Arbuckle	Core drill
Atchison	29-65-39W	Cities Service	2,425	Hunton	Core drill
			8,315? (plus)		

* Tight holes or stratigraphic tests on which information is unavailable or of doubtful value.

NEBRASKA

Wildcat drilling in Nebraska in 1942 was uniformly unsuccessful. Forty-three wildcat tests were completed and their geological background was as follows: seismograph, 3; surface, 2; core drill, 3; surface and core drill, 4; seismograph and

TABLE IX

WESTERN NEBRASKA WILDCATS, 1942

County	*Sec.-T.-R.*	*Operator*	*Total Depth (Feet)*	*Formation*	*Method*
Harlan	15- 1-18W	Ohio & Veeder Alter	4,210	Arbuckle (?)	Core drill
Harlan	15- 2-18W	Veeder (Battin)	4,198	Arbuckle	Core drill
Harlan	28- 2-18W	Ohio (Hanes)	3,933	Arbuckle	Core drill & Seismograph
Red Willow	11- 2-28W	Sinclair Prairie	Tight	Pre-Camb. (?)	Chance
Adams	35- 5- 9W	Ohio (Bauder)	4,125	Pre-Camb.	Seismograph
Frontier	21- 5-29W	Sinclair Prairie (Brown)	*	Pre-Camb.	Chance
Adams	18- 6-12W	Essinger (Roth)	2,430	Penn.	Chance
Lincoln	16- 9-33W	Texon	4,635	Pre-Camb.	Seismograph (?)
Hall	11-12-11W	Nebraska-Wyoming	3,500	Arbuckle	Chance
Lincoln	16-12-26W	Aiken Oil & Parker	3,521½	Pre-Camb.	Chance
Sherman	21-13-13W	Carter Oil	3,405	Arbuckle	Seismograph
Custer	13-13-20W	Sinclair Prairie	*	Pre-Camb. (?)	Chance
Keith	21-14-37W	California-Nebraska (OWPB)	3,658	Permian	Chance
Keith	26-14-37W	O. O. Pet.	1,750?	?	Chance
Keith	27-16-39W	Keys (Povaldo)	826?	Tertiary	Chance
Greeley	28-17-12W	Bredthauer No. 1 Fee	3,454	Arbuckle	Chance
Scotts Bluff	6-20-54W	Fuerst Prod. (Dorsch)	2,725		Chance
Morrill	10-23-49W	C. L. Price	4,683	Permian	Chance
Cherry	23-25-35W	Sinclair-Prairie	*	Pre-Camb. (?)	Chance
		EASTERN NEBRASKA WILDCATS, 1942			
Gage	14- 1- 6E	Linn *et al.*	2,775	Pre-Cambrian	Chance
Pawnee	4- 1-10E	Blazier *et al.* OWDD	907	Pre-Cambrian	Chance
Pawnee	13- 1-16E	B. E. Thorne *et al.*	539	Pre-Cambrian	Chance
Richardson	24- 1-15E	Towle & Weaver	920	Pennsylvanian	Chance
Richardson	5- 1-17E	Ohio Oil	†2,590(?)	"Miss. lime"(?)	Surface & C.D.
Richardson	5- 1-16E	Campbell	2,181	Mississippian	Chance
Richardson	24- 1-17E	Ferguson *et al.*	2,531	Hunton	Surface & C.D.?
Richardson	29- 2-13E	Towle *et al.*	1,822	Pre-Cambrian	Chance
Gage	27- 2- 7E	Gage Co. Development	1,975	Pre-Cambrian	Surface
Richardson	31- 2-15E	Richco Oil OWDD	3,582	Viola	Chance
Richardson	31- 2-17E	Ohio Oil	†	Hunton (?)	Surface & C.D.
Gage	16- 3- 5E	Bee Dee Oil	1,095	Pennsylvanian	Chance
Gage	15- 3- 6E	Nuttle *et al.*	325	Permian	Chance
Gage	5- 3- 7E	Jones *et al.*	1,150	Pennsylvanian	Chance
Richardson	16- 3-16E	Cities Service Oil	2,705	Hunton	Core drill & Seismograph
Richardson	34- 3-16E	Davisson *et al.*	2,606	Hunton	Chance
Gage	2- 4- 6E	Miller *et al.* OWDD	980	Pennsylvanian	Chance
Nemaha	6- 4-14E	Ohio Oil	†2,848	Hunton	Core drill (?)
Johnson	29- 6-10E	Anderson & Stone	350(?)	Pleistocene	Chance
Nemaha	21- 6-13E	M. J. Sullivan	3,026	Pre-Cambrian	Surface
Nemaha	34- 6-15E	Gulf Oil	3,515	Pre-Cambrian	Surface & C.D.
Sarpy	3-12-11E	Sherrod & Allen	1,323	Pre-Cambrian	Chance
Sarpy	15-13-12E	Simmons *et al.* OWDD	1,300(?)	Pre-Cambrian	Chance
Dakota	33-28- 8E	Peder Skivver	1,300(?)	Pre-Cambrian	Chance
			42,245		

* Tight hole; no information released.
† Tight holes. Little information available.

core drill, 2; and 29 tests were drilled at random. A summary of Nebraska wildcatting is shown in Table IX.

Several stratigraphic tests were drilled in various parts of the state, the geological information on which will be of considerable value when released. As

usual, most of the wildcats were drilled either to the Arbuckle or the pre-Cambrian. Random drilling accounts for many of the tests, but the subsurface information given from this type of prospecting in some cases is of greater value than that from wells scientifically located.

Wildcats drilled in eastern Nebraska consisted primarily in tests by major companies of surface or core-drill anomalies. Tests by independent operators, to a large degree, were located west of the Fall City producing area. Much important stratigraphic and structural information was discovered by these tests, although few encouraging showings of oil were found.

A greater proportion of the western Nebraska wildcat tests in 1942 were drilled by major companies than in previous years, although several of these wells were tight holes or stratigraphic tests. For the most part, the information derived from this drilling merely increased knowledge of the Cambridge arch, trending northwest and southeast between the Central Kansas uplift and the Black Hills. The general result was to discourage rather than encourage prospecting on the higher part of this arch. Sufficient information is not yet available to locate accurately the flanks of the arch or to appraise its producing potentialities. Much additional drilling is necessary which may involve a long period of time. The discovery early in 1943 of the North Dayton pool in Kansas, located only 8 miles from the south line of Harlan County, Nebraska, no doubt will give further encouragement to prospecting in this part of the state.

The abandonment of three tests in Harlan County in 1942 was disappointing in that two of these wells had given some indication of the first commercial production of oil in western Nebraska. As usual, many reports of oil showings in wildcat wells proved to be unfounded upon examination.

The cumulative production for Nebraska to the end of 1942 was approximately 3,430,000 barrels, of which 2,929,000 barrels are attributed to the Fall City pool and 384,000 barrels to the Barada pool. The Schubert pool has produced about 102,000 barrels and the Dawson pool about 17,000 barrels. Development at the close of the year had practically ceased in these four fields and there was little reason to believe that much additional drilling would be done. No attempt has been made to develop these fields according to modern engineering practice except in the Barada pool where the Skelly Oil Company has restricted production to 100 barrels per well per day. As a result, water encroachment has been severe on many leases and initial production per well has declined rapidly. Unless additional reserves are found soon, it is believed that Nebraska production will continue to decline.

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DEVELOPMENTS IN EASTERN INTERIOR BASIN IN 1942[1]

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ABSTRACT

Exploratory drilling in the Eastern Interior basin continued in 1942 at about the same rate as in 1941 and resulted in the discovery of 54 new pools, all of which are small. In Illinois, the largest pools discovered in 1942 as measured in number of wells at the end of the year were the Covington pool, Wayne County, with 32 wells and a total yield to the end of 1942 of 1,070,000 barrels and the Bible Grove pool, Clay County, with 32 wells and a total yield of 55,000 barrels. The Markham City pool, Jefferson County, with 12 wells at the end of the year, had a total production during the year of 143,000 barrels.

The total number of completions, including both wildcat and pool wells, in the Eastern Interior basin was 2,518 (excluding gas input and salt water disposal wells) in 1942 as compared with 4,680 in 1941, a decline of nearly one-half. The reduction of drilling in pools was probably mainly the result of Federal Conservation Order M-68 issued December 23, 1941, which limited drilling to one well to 40 acres. A modification of this order was issued August 31, 1942, M-68-5, which permitted closer spacing for sandstone wells. With the wider well spacing there was a notable increase in the proportion of dry holes from 27 per cent in 1941 to 44 per cent in 1942.

Nearly all of the new pools discovered during 1942 produce from the Mississippian system, including both the Chester and Iowa series. A few of the new pools produce from the Pennsylvanian and Devonian systems and one, the St. Jacob pool, Madison County, Illinois, produces from the "Trenton" limestone of the Ordovician system. This caused a considerable revival of interest in the "Trenton" possibilities of western Illinois, but numerous tests resulted in no additional discoveries to March 1, 1943.

Production in the Eastern Interior basin in 1942 amounted to approximately 117,671,000 barrels which was a decline of 19 per cent from the figure of 145,534,000 barrels in 1941. (These totals include a small amount of production in northeastern Indiana and eastern Kentucky outside of the Eastern Interior basin.) These figures represent 8.5 per cent of the national total in 1942 as compared with 10.3 per cent in 1941.

INTRODUCTION

The number of well completions in the Eastern Interior basin in 1942 was 2,518 as compared with 4,615 in 1941, a decline of nearly half. The decrease was due partly to the federal regulation of well spacing and partly to the failure to find new major pools. At least 54 new minor pools were discovered during the year, of which 40 are in Illinois, 11 in southwest Indiana, and 3 or more in western Kentucky.

Table I shows the comparative amount of drilling in 1941 and 1942.

TABLE I

COMPARATIVE AMOUNT OF DRILLING IN 1941 AND 1942

	Number of Completed Wells	
	1941	*1942*
Illinois	3,838	2,017
Southwestern Indiana	463	315
Western Kentucky	314	186
	4,615	2,518

The total oil production from the Eastern Interior basin in 1942 amounted to approximately 117,671,000 barrels which was a decline of 19 per cent from 145,534,000 barrels in 1941. Both figures include a small amount of production in

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northeastern Indiana and eastern Kentucky outside of the Eastern Interior basin. These represent 8.5 per cent of the national total in 1942 as compared with 10.3 per cent in 1941.

For further information on the statistics of oil and gas development in 1942 the reader is referred to the annual transactions of the A.I.M.E. Petroleum Division for 1943.



FIG. 1.—Index map of the Eastern Interior basin and of Illinois basin (deep part of Eastern Interior basin).

Figure 1 is an index map showing the extent of the Eastern Interior basin in Illinois, Indiana, and Kentucky, and the Illinois basin which is the term used for the central deep part of the Eastern Interior basin.

ILLINOIS

Figure 2 is an index map showing the Illinois basin counties (deep part of Eastern Interior basin), the marginal counties, and the outside counties. A comparison of the amount of wildcat drilling in 1942 and its relative success in the discovery of new pools and extensions in the three areas is given in Table II.



FIG. 2.—Index map of counties with respect to Illinois basin.

The pattern of new discoveries in 1942 with respect to regional structure, therefore, follows closely that of 1941.

EXPLORATORY METHODS

Of the 549 wildcat wells completed in Illinois in 1942, 360 were located by geology (including 82 located by "trend" only), 29 were located by seismograph, and 19 by a combination of seismograph and geology. Of the remaining 141 wells, 90 were not located by any scientific method and for 51 the method of location is unknown.

TABLE II

DISTRIBUTION OF ILLINOIS WILDCAT WELLS

	Wildcat Wells	*New Pools*	*Extensions*	*Total*	*Per Cent Productive*
Illinois basin counties	345	31	43	74	21
Marginal counties	131	7	4	11	8
Outside counties	73	2	1	3	4
	549	40	48	88	16

TABLE III

METHOD OF LOCATION OF WILDCAT WELLS IN ILLINOIS IN 1942

	Wildcats	*Producers**	*Per Cent Successful*
Geology	360	68	19
Seismograph	29	5	17
Seismograph and geology	19	5	26
Total scientific	408	78	19
Non-scientific	90	7	8
Unknown	51	11	20
	549	96*	17

* Includes 6 small gas wells from which no gas has been marketed and 2 small oil wells which were not commercial, but which might be edge wells.

STRATIGRAPHIC DISTRIBUTION OF NEW POOLS AND EXTENSIONS

Nearly all of the new pools and extensions discovered in 1942 produce from formations of Mississippian age and were about equally divided between the Chester series (Upper Mississippian) and the Iowa series (Lower Mississippian). Three small pools were discovered in Pennsylvanian sandstones, one in the vicinity of the old field in Clark County and two in western Illinois. There was one Devonian discovery—Bartelso South (Clinton County), with only one well producing at the end of the year. The discovery of a new "Trenton" limestone (Ordovician) pool—the St. Jacob pool, Madison County, caused considerable activity in western Illinois but without any additional "Trenton" discoveries. The St. Jacob pool, approximate depth to top of "Trenton" 2,300 feet, had 23 producing wells at the end of 1942, a proved area of 720 acres, and total yield of 261,000 barrels.

DEEP TESTING

The test drilling of formations below the McClosky "lime" in 1942 has been largely confined to the marginal areas around the Illinois basin. About 20 wildcat "Trenton" tests were drilled in Madison, St. Clair, Clinton, and Monroe counties in western Illinois following the discovery of the St. Jacob pool in Madison County, June 2, 1942. Seven Devonian and one St. Peter tests were drilled in Edgar, Coles, Clark, and Crawford counties, in or near the old Southeastern Illinois oil field. The deepest Devonian tests were two located in Jefferson County, one of them about one mile north of the King pool. Several "Trenton" tests were drilled in the vicinity of the Colmar-Plymouth pool, McDonough County.

GEOLOGICAL SOURCE OF OIL

Because many leases in Illinois produce from formations of more than one age and the oil is run into the same tanks, no separate record is kept of the amount of oil from the different formations. However, in the pools producing in part from the Devonian and "Trenton" formations, the oil companies are able to estimate with some degree of assurance the relative amount of oil from these deeper formations. The estimated figures for Devonian and "Trenton" production were

arrived at after consultations with companies concerned. The estimates for the Pennsylvanian production take into consideration the number of wells producing from the Pennsylvanian in each pool in comparison with the total number of producing wells in the pool. This estimate is of course subject to a large error but

TABLE IV

STRATIGRAPHIC DISTRIBUTION OF NEW POOLS AND EXTENSIONS DISCOVERED IN 1942

System or Series; Formation	*New Pools*	*Extensions*
Pennsylvanian system		
Sandstone	3	1
Mississippian system		
Chester series		
Palestine	0	1
Waltersburg	1	0
Tar Springs	0	1
Cypress	3	3
Bethel	4	6
Aux Vases	10	14
Iowa series		
Ste. Genevieve		
Levias	2	3
Rosiclare	0	5
Fredonia (McClosky)	17	15
Devonian system		
Limestone	1	0
Ordovician system		
"Trenton" limestone	1	1
	42*	50*

* These numbers exceed the actual number of new pools and extensions (40 and 48, respectively) because some of the discovery wells produced from more than one formation.

it is more likely to be too high than too low. The remainder of the production of the state, after subtracting the estimates for the Pennsylvanian, Devonian, and Ordovician, was assigned to the Mississippian. No attempt has been made to divide the Mississippian production between the Chester series and Iowa series as this is regarded as too uncertain.

INDIANA

The following statement on oil and gas activity in Indiana in 1942 was contributed by Ralph E. Esarey, State geologist, and George V. Cohee, assistant State geologist, Division of Geology, Department of Conservation, Indianapolis, Indiana.

During the past year 349 wells were drilled for oil and gas in the state. Of this number, 125 oil wells and 21 gas wells were successfully completed and 203 were dry holes. Drilling activity declined 37 per cent in 1942 as compared with the previous year, 1941. This reduction of drilling was brought about largely by Federal Conservation Order M-68, restricting drilling to one well on 40 acres in order to save steel. This order was later supplemented to permit closer spacing of wells drilled to sandstone formations in southwestern Indiana.

Most of the drilling in 1942 was in the southwestern part of the state. Posey County ranked first with 94 completions and 44 producers and Gibson County was second, with 77 completions and 38 producing oil wells and 2 gas wells. A total of 589,734 feet of hole was drilled, of which 231,702 feet was wildcat footage. The total initial production of the oil wells completed was 9,974 barrels, and of the gas wells, 11,148,000 cubic feet.

Of the 349 wells completed last year 122 were wildcat wells. Twenty-six wildcat wells were completed as oil wells, 17 were extensions to proved fields, and 9 discovered new pools. Thirty-five per cent of the wells drilled in 1942 were wildcat as compared with 25.5 per cent in 1941. It is anticipated that the percentage of wildcat wells drilled in 1943 will be greater, although the total number of wells drilled will probably be less.

TABLE V

OIL PRODUCTION IN ILLINOIS IN 1942, ESTIMATED BY GEOLOGICAL SYSTEMS

System	*Barrels*	*Per Cent*
Pennsylvanian	3,000,000	2.8
Mississippian	96,644,000	90.7
Devonian	5,626,000	5.3
Ordovician ("Trenton")	1,320,000	1.2
	106,590,000	100.0

The new discoveries in Indiana in 1942 were, for the most part, one-well pools in the southwestern part of the state, in Posey, Gibson, and Spencer counties. Most of the development in pools took place in the Hazleton and Kirksville pools in Gibson County, the Mt. Vernon pool in Posey County, and the Vernon Heights pool in Vanderburgh County. Deeper production was obtained from the Osage limestone in the Hazleton pool at a depth of 2,402 feet, 650 feet below the productive McClosky limestone. The well had an initial production of 140 barrels.

Extensions to 17 pools in the southwestern part of the state were successfully completed. There were 7 extensions in Posey County, 5 in Gibson County, 2 in Knox County, and 1 each in Spencer, Vanderburgh, and Warrick counties.

An interesting development was new production from the Devonian limestone in the Dodds Bridge pool in Sullivan County. The Ohio Oil Company deepened one of its wells, which had been producing from a shallow sand, to the Devonian, and it was completed, with an initial production of 77 barrels. Five other Devonian producing wells were completed in that area.

Crude-oil production in Indiana in 1942 was 6,641,000 barrels. The Griffin field, Gibson and Posey counties, which produced approximately 3,550,000 barrels, accounted for more than half of the production in the state. The Mt. Vernon and New Harmony fields were next in importance of production, with 684,000 and 523,000 barrels, respectively.

Natural gas produced and marketed during the year totaled 1,630,000,000 cubic feet. The Rockport gas field in Spencer County ranked first with the production of 594,316,000 cubic feet. The Unionville field in Monroe County and

Greensburg field in Decatur County were second and third with 239,856,000 and 210,827,000 cubic feet, respectively.

There was very little pipe-line activity in the State during 1942. Short lines were constructed in southwestern Indiana to provide outlets to the new fields. The Gulf Pipe Line Corporation completed the loops in its main line to Dublin, Indiana.

Repressuring is being conducted in the Griffin field with the dry gas from the Warren Petroleum Company's natural gasoline plant on the Illinois side of the Wabash River. This plant was put in operation in August, 1942, and to the end of the year it had processed approximately 500,000,000 cubic feet of gas from the Griffin field. At present approximately 1,530,000 cubic feet of dry gas is injected daily into the producing sands in the field through 14 input wells. The Waltersburg sand in the Ribeyre Island part of the New Harmony field is being repressured with 360,000 cubic feet of dry gas per day from the same plant through 4 input wells.

KENTUCKY

The following statement on development in western Kentucky in 1942 was furnished by D. J. Jones, State geologist, Lexington, Kentucky.

During the second half of 1942, western Kentucky, as a result of the completion of Burbank No. 1 in the Smith Mills area of Henderson County, had a revival of drilling activities. More than 20 producing wells were drilled, and the field is still in the development stage. The main "pay" is the Cypress sand of Chester age, and the McClosky of the Lower Mississippian has also proved productive. Some wells in this pool have attained a flush production of more than 750 barrels per day, and the general average seems to be approximately 500 barrels.

This discovery led to the drilling of numerous wildcat wells in Henderson and Union counties. As a result, new pools were discovered at Uniontown in Union County, and the Wathen pool was discovered a few miles southwest. The productive sand in the Uniontown pool is the Waltersburg (Chester) and in the Wathen pool the Waltersburg and McClosky. Later development indicates that any of the Chester sands now producing in the tri-state fields may be expected to produce in this general area.

Likewise, it is evident that other pools will be discovered in the basin area north and south of the Rough Creek fault zone. Several large companies are increasing their holdings in the Western Kentucky coal basin, and it is certain that drilling activities in that area will increase rapidly during 1943.

A recapitulation of drilling operations in 20 counties of western Kentucky for the year reveals that 186 tests were drilled, of which 99 were dry. Of the 87, there were 5 gas and 82 oil wells, resulting in a total initial production of slightly more than 14,000 barrels. Production was found in beds ranging in age from Pennsylvanian to Silurian. The sands of Chester age accounted for nearly 70 per cent of

the new production. The McClosky of the Lower Mississippian is being found productive in several places, and pools comparable with those found in the Illinois basin may be expected.

The over-all picture for western Kentucky in 1942 has focused anew the attention of large and small operators upon this area of comparatively shallow drilling.

Spacing regulations do not present a serious problem. However, the low price of crude oil is discouraging wildcatting to the extent that new productive areas are not discovered with sufficient rapidity to prove any large amount of new reserves so important at this time.

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VOL. 27, NO. 6 (JUNE, 1943), PP. 822-834, 1 FIG.

DEVELOPMENTS IN MICHIGAN IN 1942[1]

H. J. HARDENBERG[2]
Lansing, Michigan

ABSTRACT

Due to wartime restrictions and the failure of discoveries to locate important pools, oil- and gas-well drilling operations in Michigan during 1942 decreased 28 per cent from 1941, although the footage drilled was only 12 per cent or 240,000 feet less. The "Basin," with two-thirds of the state's completions, continued to be the most active district.

During 1942, twenty-one oil fields and extensions and two gas fields were discovered. The most promising discoveries in the "Basin" district were the Evart, Fork, Prosper, East Norwich, and South Adams fields. In southwestern Michigan, the South Zeeland and North Bangor fields were discovered and partially developed. Oil production was more than 21,750,000 barrels, an increase of 23 per cent over 1941 and only approximately 1,750,000 barrels less than the state's greatest production in 1939.

Gas-well completions decreased during 1942. Activity centered in the development of previously discovered fields in Clare and Osceola counties where two-thirds of the new gas wells were drilled. Gas production increased 18 per cent over 1941, reaching more than 17,700,000,000 cubic feet, a new all-time record.

The discovery of new productive zones in deeper formations opened an entirely new field of development in the state. Commercial production was established from the Detroit River and Sylvania formations (Devonian) in six areas in the "Basin" district. In one area in southwestern Michigan production was found near the Bass Island-Salina contact (Silurian). The age of the producing stratum is not yet determined.

Core-testing activity was greater during 1942 than in any previous year. Approximately 300 tests were drilled principally in the northern and northwestern parts of the Southern Peninsula.

INTRODUCTION

Activity in oil and gas operations decreased during 1942, the number of well completions dropping to 682 from the 951 of 1941. This reduction can be attributed to wartime orders on spacing, to priorities, and to the fact that few important new fields were discovered. Total footage drilled during 1942 was 1,762,201 feet contrasted with 2,002,341 in 1941. During the year twenty-three oil and gas fields and extensions were discovered, the majority of which were in the "Basin" district. The discovery of commercial pay zones in deeper formations in seven areas highlighted the year's activity. Exploration work increased greatly during 1942. More than 300 core tests were drilled, principally in the northern and northwestern parts of the Southern Peninsula.

NATURAL GAS

Drilling operations for natural gas declined during 1942. Seventy-four gas wells were completed during the year contrasted with ninety-seven completions during 1941. Natural-gas development was centered in previously discovered fields in Clare and Osceola counties. Two discoveries (Fig. 1) made later in the year were not developed by the year's end. However, gas production was greater in 1942 than in any previous year: 17,749,249,000 cubic feet of gas were produced,

[1] Presented by title before the Association at Fort Worth, April 7–9, 1943. Manuscript received, April 1, 1943.

[2] Assistant petroleum geologist, Michigan Department of Conservation, Geological Survey Division.

an increase of 18 per cent over 1941. Table II shows the production of the gas fields of the state.

FIELD DEVELOPMENT

The Marion field in Clare and Osceola counties, discovered in 1940, was enlarged by thirty wells and is now approximately 9,500 acres in extent. The "Michigan Stray" sandstone is the productive zone in the field.

The Evart field in Osceola County, T. 18 N., R. 8 W., which was discovered late in 1941, was augmented by eleven wells during the year so that it now contains approximately 2,100 acres. Production is from the "Michigan Stray" sandstone.

DISCOVERIES

The North Adams field, Arenac County, was discovered by Don Rayburn's Mee No. 1, Sec. 4, T. 19 N., R. 3 E. During the drilling of the well, 640,000 cubic feet of gas from the Berea sandstone were gauged. The well was drilled to the Dundee formation which was found to be non-productive and was then plugged back to 1,642 feet and completed as a gas well in the Berea with an initial open flow of 300,000 cubic feet and a well-head pressure of 830 pounds per square inch.

The Fork gas field was discovered by the Belvidere Oil Company's State of Michigan No. 1, Sec. 11, T. 16 N., R. 7 W., Mecosta County, on December 18, 1942, at a depth of 1,489 feet in the "Michigan Stray" sandstone. The well had an initial open flow of 1,010,000 cubic feet and a reported well-head pressure in excess of 500 pounds per square inch.

PANHANDLE AND EASTERN GAS TRANSMISSION LINE

Construction of the Panhandle and Eastern Pipeline Company's transmission line which was started in 1941 was completed late in the year. The line, totaling 250 miles, begins at the Michigan Gas Transmission Corporation line in the southeastern corner of Lenawee County and goes north to Pleasant Lake, Washtenaw County, where it branches, one line going westward connecting with Battle Creek and Jackson and extending to Kalamazoo and the other line going northward to Saginaw where it connects with the Consumers Power Company's line.

OIL

The "Basin" continued to be the most active district in Michigan during the year, both in oil-well completions and discoveries (Table IV). Comparative distribution of wells between the two major producing areas of the state is shown in Table I. Production was established in deeper formations in seven areas of the state. Oil production (Table III) increased 23 per cent over 1941 and was only 1,750,000 barrels less than the record production of 1939.

BASIN DISTRICT

FIELD DEVELOPMENT

Development in previously discovered fields in the "Basin" centered in the Reed City, Kawkawlin, and Headquarters oil fields.

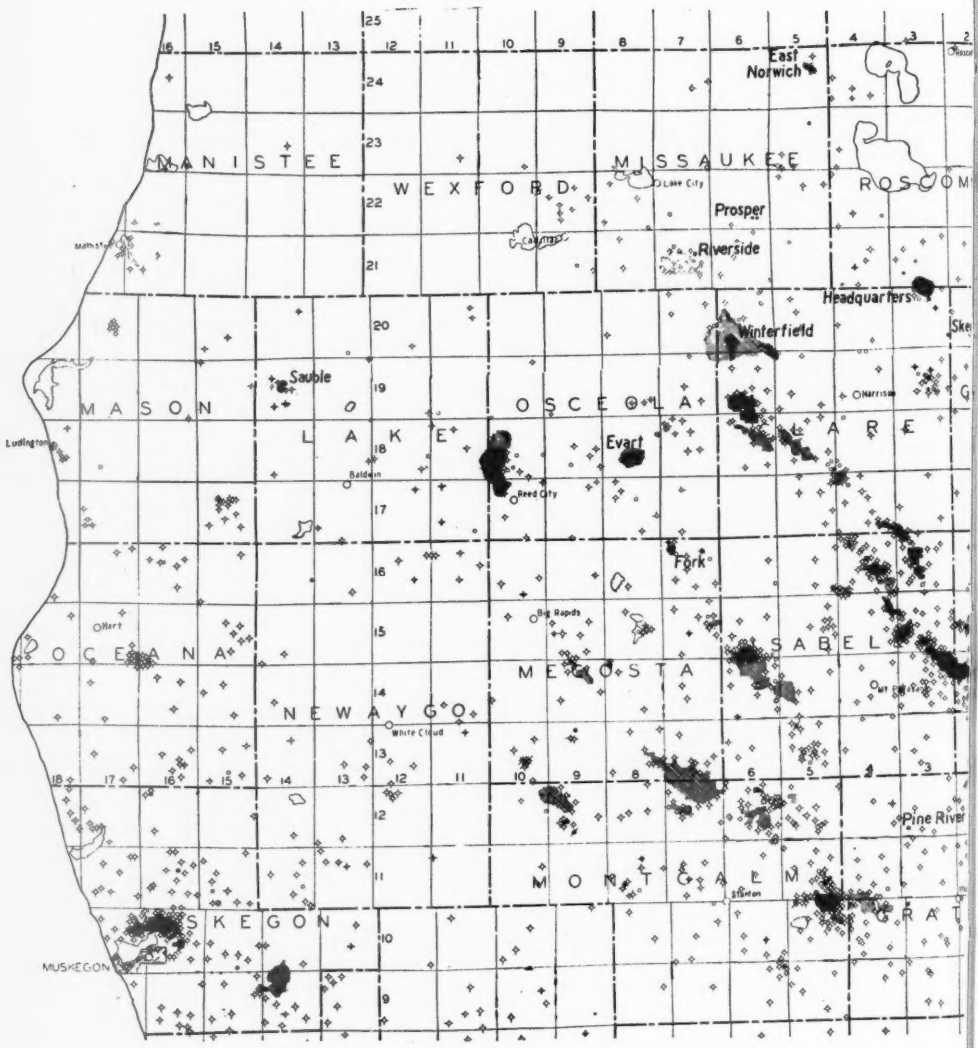
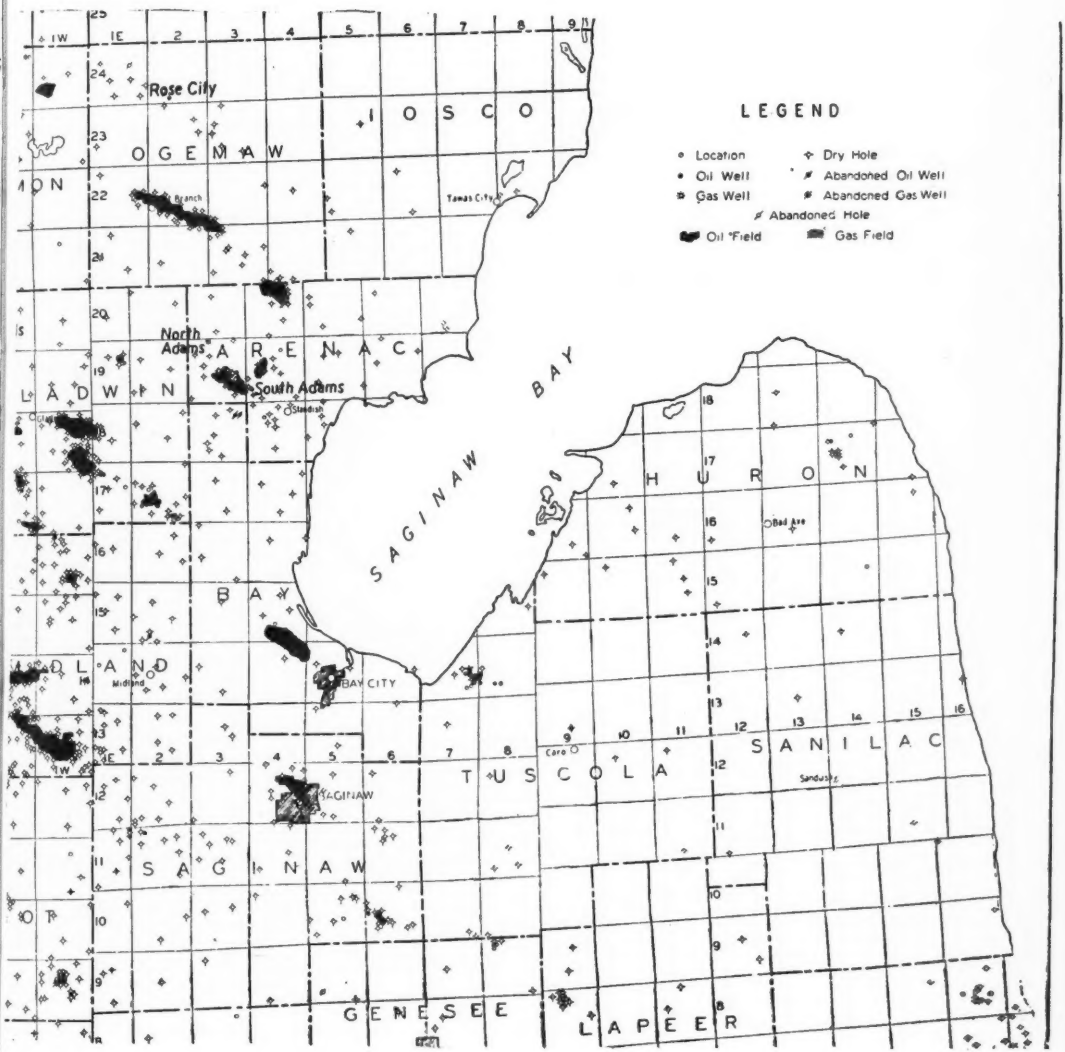

East Norwich
MANISTEE
WEXFORD
MISSAUKEE
ROSCOMM
Lake City
Prosper
Riverside
Cadillac
Manistee
Headquarters
Winterfield
Sauble
MASON
LAKE
OSCEOLA
Harrison
Ludington
Baldwin
Reed City
Evart
Fork
Hart
OCEANA
Big Rapids
MECOSTA
SABEL
NEWAYGO
White Cloud
Pine River
MONTCALM
Stanton
MUSKEGON

FIG. 1


LEGEND
Location
Oil Well
Gas Well
Dry Hole
Abandoned Oil Well
Abandoned Gas Well
Abandoned Hole
Oil Field
Gas Field
Rose City
OGEMAW
IOSCO
Tawas City
North Adams
South Adams
ARENAC
SAGINAW BAY
HURON
Bad Axe
BAY
BAY CITY
Midland
SANILAC
Sandusky
TUSCOLA
SAGINAW
GENESEE
LAPEER

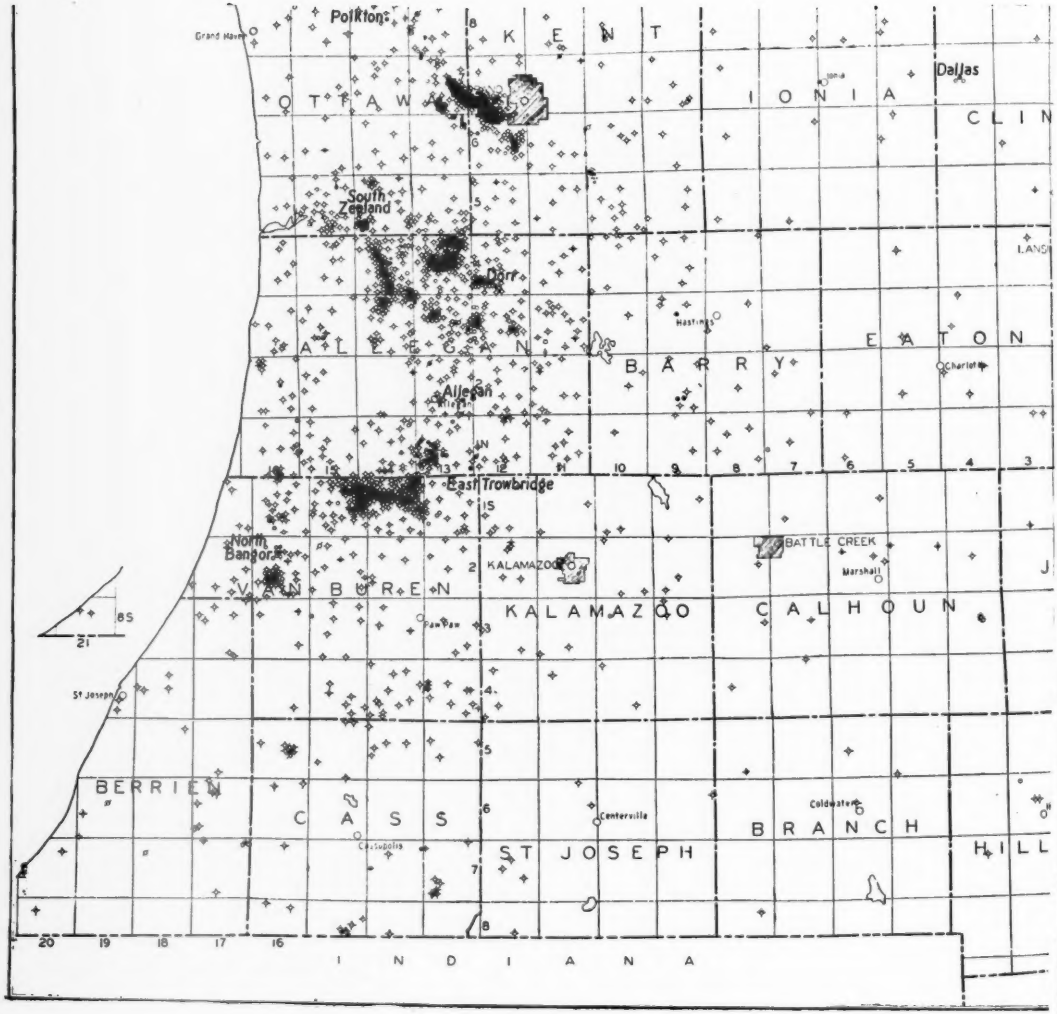


FIG. 1 (*continued*)

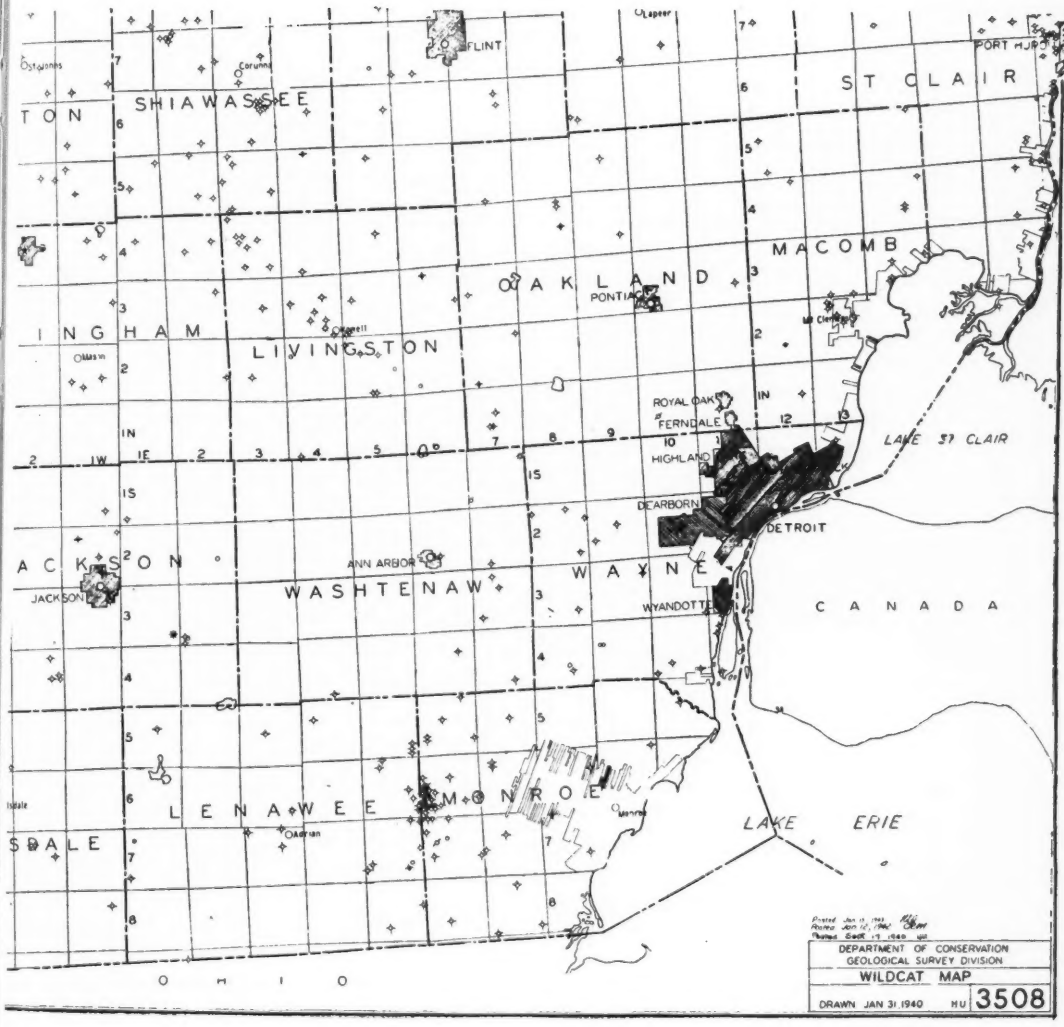

FLINT
PORT HURON
ST CLAIR
SHIAWASSEE
MACOMB
OAKLAND
PONTIAC
INGHAM
LIVINGSTON
ROYAL OAK
FERNDALE
HIGHLAND
LAKE ST CLAIR
DEARBORN
DETROIT
ANN ARBOR
WASHTENAW
WAYNE
JACKSON
WYANDOTTE
CANADA
LENAWEE
MONROE
LAKE ERIE
OHIO
DEPARTMENT OF CONSERVATION
GEOLOGICAL SURVEY DIVISION
WILDCAT MAP
DRAWN JAN 31 1940
MU 3508

TABLE I

SUMMARY OF OPERATIONS, BY DISTRICTS, IN MICHIGAN DURING 1942

Area	Permits Issued	Wells Completed	Oil Wells	Initial Production Oil (Barrels)	Gas Wells	Initial Production Gas (1000 Cu. Ft.)	Dry Holes	Total Production 1942	
								Oil (Barrels)	Gas (1000 Cu. Ft.)
Southwestern Michigan	166	190	61	4,494	4	6,390	125	2,552,604	882,426
Basin	361	445	234	253,339	68	309,995	143	19,131,788	16,866,823
All other parts of state	43	47	2	27	2	156	43	69,289	
Total	570	682	297	257,860	74	316,541	311	21,753,771	17,749,249

The Reed City field, Osceola and Lake counties, discovered in 1940, was extended south into Secs. 4, 5, 6, and 8 of T. 17 N., R. 10 W. Sixty-eight new wells were drilled and the area of the field increased to 5,000 acres. During June the field had a peak average daily production of 28,557 barrels. Some oil is produced from the Traverse and Dundee formations, but most of the production is from the Detroit River formation.

The Kawkawlin field, Bay County, was extended about 2 miles northwest by the United Drillers and Producers' Blohm No. 1, Sec. 28, T. 15 N., R. 4 E. During the year forty-three new wells were drilled and the area of the field increased to 3,700 acres. The average daily production for the field reached 1,727 barrels during October. The Dundee is the principal producing formation.

Since its discovery in 1941, the Headquarters field, Roscommon and Clare counties, has been enlarged to about 1,400 acres by the addition of twenty-eight wells which produce from the Traverse formation. Peak production for the field was during June when an average of 8,382 barrels per day was produced. Production is from the Traverse formation except for three wells which produce from the Detroit River formation (see Deep-Pay Discoveries).

DISCOVERIES

The Evart oil field, Osceola County, was discovered, May 1, 1942, at 3,781 feet in the Dundee formation by the Sun Oil Company's Arndt No. 1, Sec. 23, T. 18 N., R. 8 W. The well had an initial flow of 298 barrels in 16 hours after acid. The pay zone extends 3–14 feet into the formation and averages about 6 feet in thickness. In December, production from the thirteen producing wells of the field averaged 1,769 barrels per day.

The Sun Oil Company's Murray No. 1, Sec. 5, T. 16 N., R. 7 W., Mecosta County, opened the Fork oil field on October 5, 1942. The well had an initial natural flow of 457 barrels per day from the Dundee formation at a depth of 3,818 feet. The pay zone is 3–6 feet below the top of the Dundee and averages $2\frac{1}{2}$ feet in thickness. At the end of the year the field with five producing wells averaged 502 barrels per day.

The Prosper field, Missaukee County, was discovered on October 9, 1942, by the Gordon Oil Company's Blue No. 1, Sec. 26, T. 22 N., R. 6 W., which was completed in the Dundee formation at a depth of 3,841 feet with a natural flow

TABLE II
GAS FIELDS IN MICHIGAN
(January 1, 1943)

Field	*County*	*Year of Discovery*	*Producing Formation*	*Depth to Pay (Feet)*	*Drilled Acreage*	*Recovery Per Drilled Acre (M.Cu.Ft.)*	*Production in 1942 (M.Cu.Ft.)*	*Accumulative Production (M.Cu.Ft.)*
Elba	Gratiot	1927	Parma	490	200	—	—	—
Muskegon	Muskegon	Dec. 1927	Traverse and Detroit River	1,640	1,200 est.	5,808	69,363	6,969,531
*Broomfield	Isabella	Oct. 1929	Mich. Stray	1,350	4,120	1,920	873,736	7,909,157
McKay	Clare	Feb. 1930	Mich. Stray	1,400	360	198	1,490	712,634
Vernon	Isabella	Aug. 1930	Mich. Stray	1,300	760	1,864	21,574	1,416,289
Austin	Mecosta	May 1933	Mich. Stray	1,385	1,200	4,799	—	5,758,534
Six Lakes	Montcalm and Mecosta	May 1934	Mich. Stray	1,270	9,520	3,212	4,129,325	30,578,902
Winfield	Montcalm	May 1935	Mich. Stray	1,125	3,040	651	546,674	1,978,643
Sheridan	Mecosta	May 1935	Mich. Stray	975	320	627	57,450	200,757
Shaver	Gratiot	May 1935	Mich. Stray	1,020	2,600	1,732	1,266,806	4,503,556
Aetna	Mecosta	June 1935	Mich. Stray	1,200	200	—	—	—
†Crystal	Montcalm	June 1935	Mich. Stray	1,000	320	1,513	56,923	484,353
Ravenna	Muskegon	Aug. 1936	"Berea"‡	1,205	4,160	307	119,001	1,276,131
Clayton	Arenac	Aug. 1936	Berea	1,180	1,440	2,317	816,376	3,336,194
Edmore	Montcalm	Aug. 1936	Mich. Stray	1,300	4,400	828	1,119,872	3,643,930
Deep River	Arenac	Aug. 1936	Berea	1,500	880	296	260,206	260,206
Clare City	Clare	Feb. 1938	Mich. Stray	1,290	720	1,592	101,083	1,145,918
Lincoln	Clare	June 1938	Mich. Stray	1,530	2,400	1,027	925,944	2,453,848
‖Walker	Kent	Mar. 1939	"Berea"	1,150	160	—	641,880	3,707,301
		Sept. 1940	Detroit River	2,250				
Freeman	Clare	June 1939	Mich. Stray	1,475	2,040	653	433,304	1,331,285
Coopersville	Ottawa	Dec. 1939	"Berea"	1,235	640	134	53,422	85,438
Richland	Montcalm	Feb. 1940	Mich. Stray	1,215	640	268	69,730	171,540
Riverside	Missaukee	June 1940	Mich. Stray	1,370	2,080	587	7,527	121,988
Marion	Clare and Osceola	June 1940	Mich. Stray	1,370	9,440	344	2,667,336	3,244,344
North Star	Gratiot	Oct. 1940	Mich. Stray	870	160	411	31,256	65,809
Wise	Isabella	Oct. 1940	Mich. Stray	1,250	800	708	258,527	566,748
Reed City	Osceola and Lake	Nov. 1940	Mich. Stray	1,220	4,480	706	2,538,971	3,163,059
South Tallmadge	Ottawa	Nov. 1940	"Berea"	1,030	200	50	99,456	99,456
°Deerfield	Isabella	Mar. 1941	Mich. Stray	1,350	—	—	—	—
Fremont	Isabella	June 1941	Mich. Stray	1,235	640	39	24,726	24,726
Sylvan	Osceola	Aug. 1941	Mich. Stray	1,525	320	—	—	—
Kawkawlin	Bay	Aug. 1941	Salina	7,350	640	—	—	—
Salem	Allegan	Oct. 1941	Salina	2,725	160	317	18,305	50,635
Evart	Osceola	Nov. 1941	Mich. Stray	1,420	2,080	14	29,860	29,860
Albion	Calhoun	Dec. 1941	Traverse	1,600	320	—	—	—
North Adams	Arenac	Nov. 1942	Berea	1,640	40	—	—	—
Fork	Mecosta	Dec. 1942	Mich. Stray	1,010	160	—	—	—
	1942 Production Dry and Casinghead Gas						17,749,249,000 cubic feet	
	Cumulative Production Dry and Casinghead Gas						99,115,319,000 cubic feet	

* Deerfield of Isabella County appears to be an extension of Broomfield. Data from Deerfield are included in Broomfield.
† Includes gas wells in Ferris and Crystal townships.
‖ There are 4 gas wells in Walker Field. Most of the gas production from the field is casinghead gas. Production figure for Walker Field includes both dry and casinghead gas.
‡ A sandy dolomite in the western part of the state at the horizon of the Berea sandstone.
° Deerfield of Isabella County appears to be an extension of Broomfield. Data from Deerfield are included in Broomfield.

of 187 barrels per day. Although no additional wells were completed during the year, it is believed the area offers possibilities for development during 1943.

DEEP-PAY DISCOVERIES

Production was found in two zones in the Detroit River formation during 1942. The upper zone, the "sour-oil" zone, is at depths ranging from 700 to 850 feet below the top of the formation. This "pay" is characterized by the high sulphur content of its oil and gas. The lower zone, 975–1,050 feet below the top, is the more important "Richfield-Sylvania" zone at the base of the evaporite beds of the Detroit River formation. The "pay" is in brown limestone or dolomite

TABLE III
Oil Fields in Michigan*
(January 1, 1943)

Field	County	Year of Discovery	Producing Formation	Depth to Pay (Feet)	API° Gravity of Oil	Drilled Acreage	Recovery Per Drilled Acre (Barrels)	Production in 1942 (Barrels)	Accumulative Production (Barrels)
Deerfield	Monroe	Apr. 1920†	Trenton	2,115	42.7	155	1,974	69,068	306,001
Saginaw	Saginaw	Aug. 1925	Berea	1,825	46.1	1,500 est.	929	20,439	1,394,513
Muskegon	Muskegon	Dec. 1927	Traverse	1,650 to 1,750	—	280 est.	2,398	27,637	6,713,856
			Dundee	2,025	37.4				
Mt. Pleasant	Isabella and Midland	Feb. 1928	Dundee	3,545	41.8	4,180	5,236	365,709	21,886,075
Leaton	Isabella	June 1930	Dundee	3,655	43.0	880	3,407	114,921	2,997,817
Vernon	Isabella	Sept. 1930	Dundee	3,755	44.1	790	5,550	98,983	4,384,449
Yost	Midland	Dec. 1932	Dundee	3,420	40.6	2,010	3,408	334,119	6,850,236
Porter	Midland	Feb. 1933	Dundee	3,415	40.6	4,330	7,521	891,229	32,565,384
West Branch	Ogemaw	June 1933	Dundee	2,650	36.8	2,670	1,831	333,197	4,889,756
Edmore	Montcalm	Dec. 1933	Traverse	3,105	43.2	90	4,807	13,474	432,619
Birch Run	Saginaw	Sept. 1934	Berea	1,530	43.3	260	766	8,866	199,093
Beaverton	Gladwin	Oct. 1934	Dundee	3,880	41.3	230	2,832	23,396	651,395
Mount Haley	Midland	Oct. 1934	Dundee	3,477	—	‡	‡	1,176	31,309
Crystal	Montcalm	Mar. 1935	Dundee	3,190	43.5	1,820	3,960	59,154	7,207,473
South Buckeye	Gladwin	July 1936	Dundee	3,570	39.0	1,880	2,017	102,616	3,791,599
South Beaverton	Gladwin	Sept. 1936	Dundee	3,845	—	320	1,105	122,556	353,759
Sherman	Isabella	Oct. 1936	Dundee	3,650	42.0	870	4,664	168,347	4,057,824
Currie	Isabella	Oct. 1936	Dundee	3,920	—	—	—	4,634	154,219
Clayton	Arenac	Nov. 1936	Dundee	2,550	34.2	600	6,087	190,492	3,652,490
Winfield	Montcalm	Nov. 1936	Dundee	3,340	43.2	—	—	7,256	47,468
North Buckeye	Gladwin	Jan. 1937	Dundee	3,615	39.0	2,710	5,424	393,510	14,700,726
Salem	Allegan	Feb. 1937	Traverse	1,570	38.3	2,100	1,401	157,293	2,941,401
Trowbridge	Allegan	June 1937	Traverse	1,355	—	490	284	55,106	138,992
Adams	Arenac	July 1937	Traverse	2,025	—	590	4,374	1,029,616	2,580,894
			Dundee	2,930	34.0				
Bentley	Gladwin	Aug. 1937	Dundee	3,505	42.1	400	1,809	86,712	723,537
Lakefield	Saginaw	Oct. 1937	Dundee	3,185	—	—	—	1,003	5,646
Edenville	Midland	Jan. 1938	Dundee	3,790	41.0	350	3,254	44,717	1,138,883
Kawkawlin	Bay	Jan. 1938	Berea	1,505	38.0				
			Dundee	2,825	35.0	1,220	589	491,855	718,611
			Salina	7,368	55.3				
Monterey	Allegan	Feb. 1938	Traverse	1,645	—	280	1,347	22,584	377,171
Pine	Montcalm	Mar. 1938	Traverse	2,836	45.0	—	—	5,235	33,148
Dorr	Allegan	Mar. 1938	Traverse	1,605	41.0	260	1,080	16,687	280,818
Clare City	Clare	Apr. 1938	Mich. Stray	1,320	30.2	—	—	4,486	21,276
Akron	Tuscola	May 1938	Detroit River	3,425	36.0	—	—	37,770	128,277
Diamond Springs	Allegan	July 1938	Traverse	1,465	41.0	410	1,836	42,911	752,745
Temple	Clare	July 1938	Dundee	3,885	43.8 to 44.8	2,500	5,211	869,700	13,027,328
Bloomingdale	Van Buren	Aug. 1938	Traverse	1,220	41.0 to 43.0	1,380	4,130	282,980	5,698,959
Overisel	Allegan	Aug. 1938	Traverse	1,490	42.1	1,550	1,321	190,884	2,048,109
Wise	Isabella	Aug. 1938	Dundee	3,705	45.2	1,060	1,631	225,251	1,729,083
Walker	Kent and Ottawa	Sept. 1938	Traverse	1,850	40.0	4,815	1,872	680,884	9,012,078
Columbia	Van Buren	Oct. 1938	Traverse	1,185	—	1,090	1,801	100,126	1,963,633
Mill Lake	Van Buren	Nov. 1938	Traverse	1,290	—	330 est.	1,312	61,087	432,915
New Salem	Allegan	Dec. 1938	Traverse	1,625	—	970	3,401	344,805	3,299,418
Hopkins	Allegan	Jan. 1939	Traverse	1,635	—	—	—	7,179	114,715
Bangor	Van Buren	Feb. 1939	Traverse	1,000	29.5	200	1,873	82,084	374,700
Wyoming Park	Kent	May 1939	Traverse	1,880	39.0	—	—	13,766	102,230
South Tallmadge	Ottawa	July 1939	Traverse	1,820	—	560	532	87,562	297,825
Porter	Van Buren	Oct. 1939	Traverse	1,140	—	—	—	1,083	2,873
Hope	Barry	Dec. 1939	Traverse	1,835	—	—	—	1,753	5,068
Holland	Ottawa	Feb. 1940	Traverse	1,516	38.4	—	—	1,420	12,967
Dalton	Muskegon	Feb. 1940	Traverse	1,855	—	—	—	678	2,193
Grout	Gladwin	June 1940	Dundee	3,825	—	—	—	5,632	17,921
Geneva	Van Buren	June 1940	Traverse	1,015	—	—	—	2,872	12,920
Casco	Allegan	Aug. 1940	Traverse	1,100	38.6	—	—	1,114	3,623
Reed City	Osceola and Lake	Oct. 1940	Traverse	2,925	—				
			Dundee	3,490	—	5,070	2,339	9,102,008	11,858,290
			Detroit River	3,585	46.3				
Winterfield	Clare	Nov. 1940	Traverse	3,105					
			Dundee	3,770	44.2	880	2,692	1,258,946	2,368,668
			Detroit River	5,015					

TABLE III—*Continued*

Field	*County*	*Year of Discovery*	*Producing Formation*	*Depth to Pay (Feet)*	*API° Gravity of Oil*	*Drilled Acreage*	*Recovery per Drilled Acre (Barrels)*	*Production in 1942 (Barrels)*	*Accumulative Production (Barrels)*
Marne	Ottawa	Nov. 1940	"Berea"	1,165	—	—	—	2,184	3,831
Sec. 11—									
Overisel	Allegan	Dec. 1940	Traverse	1,553	—	—	—	1,208	5,873
Headquarters	Roscommon and Clare	June 1941	Traverse	3,380	40.9	1,440	1,830	2,320,882	2,635,652
			Detroit River	4,955	48.9				
Muskrat Lake	Van Buren	June 1941	Traverse	1,285	39.2	560	381	101,233	213,642
Otisville	Genesee	Aug. 1941	Traverse	1,894	44.3	—	—	2,081	3,083
West Hopkins	Allegan	Sept. 1941	Traverse	1,580	—	310	999	222,488	309,841
Hatton	Clare	Nov. 1941	Dundee	3,939	—	—	—	1,313	6,762
South Akron	Tuscola	Nov. 1941	Dundee	2,850	—	—	—	5,192	5,943
Richfield	Roscommon	Dec. 1941	Detroit River	4,185	—	440	163	70,356	71,933
Dallas	Clinton	Feb. 1942	Traverse	2,482	—	—	—	1,328	1,328
South Adams	Arenac	Mar. 1942	Detroit River	4,230	40.0	—	—	14,343	14,343
Sauble	Lake	Mar. 1942	Traverse	2,145	35.6	—	—	26,686	26,686
Polkton	Ottawa	Mar. 1942	Traverse	1,880	—	—	—	246	246
Riverside	Missaukee	Apr. 1942	Dundee	3,944	44.5	—	—	12,433	12,433
Evart	Osceola	May 1942	Dundee	3,745	47.8	520	381	198,192	198,192
Allegan	Allegan	May 1942	Traverse	1,407	—	—	—	244	244
South Zeeland	Ottawa	May 1942	Traverse	1,490	40.4	—	—	35,672	35,672
East Norwich	Missaukee	July 1942	Dundee	3,082	—	—	—	3,202	3,202
			Detroit River	4,435					
Pine River	Gratiot	Aug. 1942	Dundee	3,282	—	—	—	2,949	2,949
Fork	Mecosta	Sept. 1942	Dundee	3,820	49.0	200	265	52,932	52,932
Prosper	Missaukee	Sept. 1942	Dundee	3,837	—	—	—	2,476	2,476
North Bangor	Van Buren	Oct. 1942	Traverse	1,010	31.3	—	—	6,516	6,516
Rose City	Ogemaw	Oct. 1942	Detroit River	4,184	—	—	—	418	418
Total oil production for Michigan in 1942						21,753,771 barrels			
Accumulative oil production in Michigan						183,347,057 barrels			

° Fields which are abandoned or have produced less than 500 barrels during 1942, except 1942 discoveries, are not included.

† Very little production from Deerfield field until revival of development in 1935.

‡ Drilled acreage and recovery per drilled acre not calculated for fields in which wells are too few or scattered to be significant.

which generally is low in permeability, resulting in wells of fairly low initial production. The first commercial production from this zone was in the Richfield field, Roscommon County, discovered in 1941. During 1942, the "Richfield-Sylvania" zone was penetrated in four other areas, indicating that it is rather widespread.

Drilling below the Traverse zone in the Headquarters field, the Sun Oil Company's State-Roscommon No. A-2, Sec. 33, T. 21 N., R. 3 W., Roscommon County, discovered oil in the "sour-oil pay" of the Detroit River formation. This well was completed at a depth of 4,970 feet on May 18, 1942, with an initial flow of 92 barrels per day after acid. Two additional wells, neither of which had a large initial production, have been drilled in the area, one about $2\frac{1}{4}$ miles southeast and the other $1\frac{1}{4}$ miles northwest.

The Skeels field was discovered by the Freeman Oil Company's Yeager No. 1, Sec. 25, T. 20 N., R. 3 W., Clare County, on October 27, 1942, at a depth of 4,851 feet in the "sour-oil pay" of the Detroit River formation. The well had an initial flow of 50 barrels after acid. No other tests have been drilled in the immediate area.

The South Adams field was discovered on March 4, 1942, by Ervin Major's Adams No. 1, Sec. 36, T. 19 N., R. 3 E., Arenac County, in the "Richfield-Sylvania" zone of the Detroit River formation at a depth of 4,229 feet. This well was

TABLE IV

Discovery Wells in Michigan During 1942

County	Field	Section Township Range	Operator	Well	Permit Number	Month and Day 1942	Feet Total Depth	Initial Production Oil (Barrels)	Initial Production Gas (1,000 Cu. Ft.)	Formation	Remarks
				"BASIN" DISTRICT							
Arenac	North Adams	4-19N-3E	Don Rayburn	Mee 1	9,390	11-3	3,101 PB 1,642		300	Berea	Dry in Dundee and plugged back
Arenac	South Adams	36-19N-3E	Ervin Major	Adams 1	9,293	3-4	4,229	800 A[2]		Detroit River	"Richfield-Sylvania pay"
Bay	Kawkawlin	28-15N-4E	United Drillers and Producers, Inc.	Blohm 1	9,585	6-25	2,943	78		Dundee	Kawkawlin field extension
Clare	Skeels	25-20N-3W	Freeman Oil Co.	Yeager 1	9,215	10-27	4,851	50 A		Detroit River	"Sour-oil pay"
Clare	Headquarters	10-20N-3W	Eugene Hilliard	Pinch 1	9,485	7-16	4,989	28 A		Detroit River	Possible extension of Headquarters field "sour-oil pay"
Clare	Winterfield	30-20N-6W	Pure Oil Company	McClain 1	8,744	9-4	5,100 PB 5,060	250 A		Detroit River	"Richfield-Sylvania pay"
Clinton	Dallas	21-7N-4W	John B. Spitzley, Tr.	Simon 1	9,033	2-13	2,934 PB 2,482	10 oil—20 water		Traverse	Dry in Detroit River and plugged back
Gratiot	Pine River	31-12N-3W	Chartiers Oil Co.	Church 1	9,661	8-24	3,285	35		Dundee	One well
Lake	Sauble	16-19N-14W	William P. Shoemaker	Matson 1	9,394	3-5	2,136	316 N[1]		Traverse	
Mecosta	Fork	5-16N-7W	Sun Oil Company	Murray 1	9,663	9-5	3,818	457 N		Dundee	
Mecosta	Fork	11-16N-7W	Belvidere Oil Co.	State 1	9,807	12-18	1,489		1,010	"Michigan Stray"	
Missaukee	East Norwich	11-24N-5W	Sun Oil Company	Horner 2	9,457	7-23	4,524	30 A		Detroit River	"Richfield-Sylvania pay"
Missaukee	Prosper	26-22N-6W	Gordon Oil Co.	Blue 1	9,672	9-9	3,845 PB 3,841	187 N		Dundee	
Missaukee	Riverside	14-21N-7W	Turner Petroleum Corp.	Cavanagh 1	9,442	4-18	3,947	380 A		Dundee	One well
Ogomaw	Rose City	33-24N-2E	Albin H. Weber & Assoc.	State F-1	8,616	10-30	5,367 PB 4,287	20		Detroit River	"Richfield-Sylvania pay"
Osceola	Evart	23-18N-8W	Sun Oil Company	Arndt 1	9,461	5-1	3,781	298/16 hrs. A		Dundee	
Roscommon	Headquarters	33-21N-3W	Sun Oil Company	State-Roscommon A-2	9,421	5-18	4,985 PB 4,970	92 A		Detroit River	Deepened "Sour-oil pay"
				SOUTHWESTERN MICHIGAN							
Allegan	Allegan	26-2N-13W	Bridger Basin Oil Corp.	Butcher 1	9,536	5-8	1,455 PB 3,028	20 oil—40 water		Traverse	One well
Allegan	Dorr	29-4N-12W	Muskegon Oil Corp. *et al.*	Podurgiel 1	5,030	12-22	3,319	45		Bass Island-Salina	Deepened
Allegan	East Trowbridge	36-1N-13W	H. M. Gibb, Tr.	Ames & Cook 1	9,690	9-18	1,365	20 oil—130 water		Traverse	One well
Ottawa	Polkton	15-8N-14W	Associated Petroleum Co. and Southwest Development Co.	Blackmer 1	9,347	3-25	1,890	15 oil—4 water		Traverse	One well
Ottawa	South Zeeland	30-5N-14W	D. M. Leonard, Tr.	Nykamp and Shultz 1	9,453	5-23	1,665 PB 1,540	40		Traverse	
Van Buren	North Bangor	9-2S-16W	Fisher-McCall Oil and Gas and M. Bliss Keeler	Davis 1	9,785	10-10	1,018	190 oil—90 water		Traverse	

[1] N, natural flow
[2] A, acidized

completed with a daily initial flow of 800 barrels after acid. The "pay" according to reports, ranges from 1 to 15 feet in thickness and is about 975 feet below the top of the formation. At the close of the year, six wells had been completed in the field, none of which, except the discovery well, had an initial production greater than 30 barrels. Total production of the field for the year was 14,343 barrels.

The East Norwich field in Missaukee County was opened by the Sun Oil Company's discovery well—Horner No. 2, Sec. 11, T. 24 N., R. 5 W. This well, completed on July 23, 1942, at a total depth of 4,524 feet in the Detroit River formation, had an initial flow of 30 barrels per day after acid. The "pay" ("Richfield-Sylvania") is about 1,050 feet in the formation. One other well was completed in the zone at the close of the year, and another well in the field found commercial production in the Dundee formation where it was completed as a 35 barrel well at 3,096 feet. In December, the three wells produced 1,342 barrels of oil.

The Pure Oil Company's McClain No. 1, Sec. 30, T. 20 N., R. 6 W., Clare County, discovered oil in the "Richfield-Sylvania" zone in the Winterfield field on September 4, 1942, at a depth of 5,060 feet. The well had an initial flow of 250 barrels per day after acid. The "pay" is about 1,000 feet below the top of the Detroit River formation. No additional wells were drilled in 1942.

Several dry holes have been drilled to the upper formations on the Rose City structure in Ogemaw County, but the discovery well opening the Rose City field was the Alvin H. Weber and Associates' State of Michigan No. F-1, Sec. 33, T. 24 N., R. 12 E., which was completed at a depth of 5,367 feet on October 30, 1942, and was later plugged back to 4,287 feet to obtain production from the "Richfield-Sylvania pay," approximately 975 feet below the top of the Detroit River formation. The well had an initial production of 20 barrels per day after acid.

SOUTHWESTERN MICHIGAN

The South Zeeland field was discoverd, May 23, 1942, by D. M. Leonard's Nykamp and Shultz No. 1, Sec. 30, T. 5 N., R. 14 W., Ottawa County. The well produced 40 barrels per day from the Traverse limestone at a depth of 1,540 feet after being plugged back from 1,665 feet. The "pay" averages 2 feet in thickness and is in the upper 5 feet of the limestone. At the end of the year the field with seven producing wells was averaging 188 barrels per day.

The North Bangor field, Van Buren County, was discovered, October 10, 1942, by Fisher-McCall Oil and Gas and M. Bliss Keeler's Davis No. 1, Sec. 9, T. 2 S., R. 16 W., in the Traverse limestone at 1,018 feet. The well had an initial production of 190 barrels of oil per day with some water. The "pay" is in the upper 5 feet of the limestone and averages only about one foot in thickness. Three producing wells had been drilled by the end of December. Average production for the field was 152 barrels per day.

The Muskegon Oil Corporation deepened its Podurgiel No. 1, Sec. 29, T. 4 N.,

R. 12 W., Allegan County, in the Dorr field. The well was drilled to a depth of 3,319 feet on December 22, 1942, and then plugged back to 3,028 feet where it was completed with an initial production of 45 barrels per day after acid. The pay zone is above the Salina salt, apparently near the Bass Island-Salina contact. This is the first discovery of commercial oil production in this zone in southwestern Michigan and it is expected that it will lead to deeper drilling in other Traverse fields in the area.

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DEVELOPMENTS IN APPALACHIAN AREA IN 1942[1]

APPALACHIAN GEOLOGICAL SOCIETY[2]
Charleston, West Virginia

ABSTRACT

NEW YORK. New development work in New York state during 1942, aside from secondary recovery operations, was confined principally to drilling for additional Oriskany gas supplies. There were 29 wells drilled in the Oriskany sand area of southwestern New York during this period. Of these only 9 were producers with a combined open flow of 6,311 M.C.F. Six of the wells drilled are considered as wildcats; 2 were completed as gas producers, 2 as dry holes, and 2 are now locations. The two producing wells discovered the two parts of the Groton field in Tompkins County, which was the only new field discovered; and, in view of present development, it is not expected to add substantially to the depleted gas reserves. Wildcat drilling is increasing in the state due to the depleted gas reserves, OPM's order M-68, and closer coöperation between companies.

PENNSYLVANIA. The number of wells completed in the shallow gas and oil territory of western Pennsylvania (Upper Devonian or higher) in 1942 was about 3 per cent less than in 1941. Of the wells drilled for gas, 80 per cent were producers and 20 per cent were dry. The 738 new gas wells had a total initial open flow capacity of 240,353 M cubic feet per day. The Armburst gas pool in Westmoreland County, discovered in 1941, was the scene of greatest activity. The productive area includes about 2,200 acres.

Outside the Bradford oil field, there was very little drilling for oil during the year. In the Bradford field production increased 11 per cent over 1941 and accounted for 54.6 per cent of the total Pennsylvania grade crude oil production of the Appalachian province in 1942. In the central and southwestern oil districts of Pennsylvania, oil production declined 11 per cent.

Successful deep drilling operations were confined almost entirely to the Summit gas pool in Fayette County. Of the seven wells completed, four were producers and three, dry holes. One well was abandoned above the Onondaga after it had passed through a fault. The new work did not extend the productive area of the pool. In the Oriskany territory of north-central Pennsylvania, two small gas wells and five dry holes were completed. No extension of productive areas occurred. Eight other deep tests were completed in western Pennsylvania during the year. One of these in northwestern Erie County reached the Trenton limestone and encountered salt water. One in Lawrence County and two in Mercer County were drilled through the Lockport dolomite of the Middle Silurian. One of the Mercer County wells is a small gas producer in the Lockport. The other four deep tests, one in Beaver, one in Fayette, one in Greene, and one in Lawrence County, were drilled through the Oriskany only and produced no oil or gas.

OHIO. Tests completed in Ohio in 1942 numbered 998. This was 36 per cent less than the total drilled during 1941. Of these, 454 were gas wells, 194 were oil wells and 350, or 35 per cent, were dry.

The total initial open-flow capacity of new gas developed was 316,446 M.C.F. A total of 3,663,872 barrels of oil was produced of which 1,751,566 barrels were of Pennsylvania grade.

The drilling in the state is summarized by counties and by sands.

WEST VIRGINIA. During the year 229 wells were drilled into or through the Oriskany sand in West Virginia. Of these 197 were gas wells with combined open flow of 1,011,096,000 cubic feet and 32 were dry holes.

The Elk-Poca and Sandyville fields (one continuous field) were well defined and the larger part of present activity is edge drilling. The entire field covers about 125,000 acres. No new areas of Oriskany sand production were opened, but at year's end, interesting tests were drilling in Tucker, Wyoming and Raleigh counties.

In the shallow sands, there were no discoveries of consequence, although various extensions of older fields were brought into gas production.

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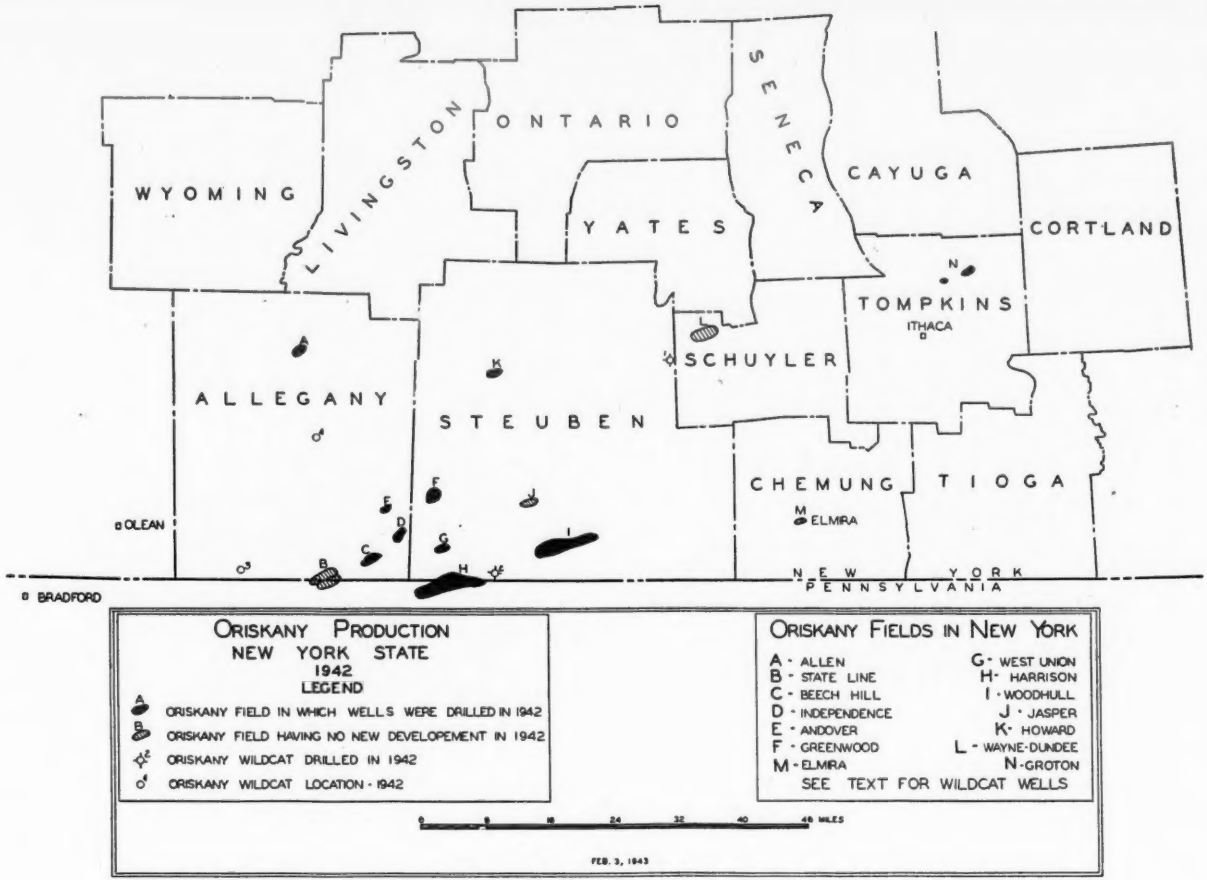

WYOMING
LIVINGSTON
ONTARIO
SENECA
CAYUGA
YATES
CORTLAND
TOMPKINS
ITHACA
SCHUYLER
ALLEGANY
STEUBEN
CHEMUNG
TIOGA
ELMIRA
OLEAN
BRADFORD
NEW YORK
PENNSYLVANIA
ORISKANY PRODUCTION
NEW YORK STATE
1942
LEGEND
ORISKANY FIELD IN WHICH WELLS WERE DRILLED IN 1942
ORISKANY FIELD HAVING NO NEW DEVELOPEMENT IN 1942
ORISKANY WILDCAT DRILLED IN 1942
ORISKANY WILDCAT LOCATION - 1942
ORISKANY FIELDS IN NEW YORK
A - ALLEN
B - STATE LINE
C - BEECH HILL
D - INDEPENDENCE
E - ANDOVER
F - GREENWOOD
M - ELMIRA
G - WEST UNION
H - HARRISON
I - WOODHULL
J - JASPER
K - HOWARD
L - WAYNE-DUNDEE
N - GROTON
SEE TEXT FOR WILDCAT WELLS
0 8 16 24 32 40 48 MILES
FEB. 3, 1943

FIG. 1

According to the Department of Mines, with figures not complete, wells completed in 1942 numbered 758. Of these, 514 were gas wells, 73 were oil wells, 20 were combination oil and gas wells, 149 were dry holes, and two were brine wells. In this period, 300 gas wells, 430 oil wells and 23 combination oil and gas wells were abandoned. New initial oil production developed with 2,234 barrels.

KENTUCKY. Most of the development in eastern Kentucky during 1942 has been for the purpose of developing additional gas reserves. Federal regulations have tended to materially reduce the amount of drilling for oil, but due to modification of the original M-68 order the adverse effect on gas development has been considerably less. The low price of oil has likewise tended to discourage drilling operations.

TENNESSEE. There were only 6 completions during the year 1942 in Tennessee east of the Cincinnati arch—2 being gas wells, and 4 dry holes. The most significant test was the Stanolind's wildcat in Putnam County, which was abandoned in the upper part of the Knox dolomite at 2,130 feet, after logging a showing of oil at 1,653–1,661 feet.

NEW YORK

During 1942 only one new field was discovered in the Oriskany sand area of southwestern New York. This was the Groton field in northern Tompkins County (Fig. 1, N). This field consists of two small closures about 4 miles apart. The one on the north was discovered by the Belmont Quadrangle Drilling Corporation's Cora Mount No. 1 with a final open flow of 1,180 M.C.F. and an initial rock pressure of 490 pounds. The southern closure was discovered by Leiderbach *et al.* George Armstrong No. 1 with a final open flow of 200 M.C.F. At present 6 producing wells have been drilled in this field having a combined open flow of 5,130 M.C.F., 9 dry holes, 3 holes abandoned on structure without completion, and 2 wells drilling. The present production has narrowed the probable producing area, and future operations in this field do not appear promising. No gas has yet been marketed from this field.

Only one well was drilled in the Allen field (Fig. 1, A) which encountered salt water in the Oriskany sand.

There was considerable activity in the Beech Hill-Independence-Andover areas (Fig. 1, C, D, and E), with a total of 5 completions—all dry holes.

Three wells were completed in the West Union field (Fig. 1, G), all of which were dry holes, and two are drilling.

One well was drilled on the north side of the Harrison field (Fig. 1, H) with an open flow of 150 M.C.F. There was no other activity in this area during 1942.

A producer was completed in the Woodhull field (Fig. 1, I) by the New York State Natural Gas Company on the Parks Estate, with an initial open flow of 467 M.C.F.

Two wells were completed, both small producers, in the Howard area (Fig. 1, K) in northern Steuben County. All activity in this area was confined to these two wells.

Two wells were drilled approximately 3 miles southwest of the Greenwood field (Fig. 1, F), both of which were completed as salt water wells in the Oriskany. At present the Greenwood field is being used primarily for storage.

Two wells were drilled in the Danby area, approximately 5 miles south of Ithaca, in Tompkins County, both of which were completed as dry holes in the Oriskany. Both wells were drilled as offsets to an Oriskany well that was drilled

some time ago and produced only a short while. Four other dry holes have been drilled in this same area.

For purposes of this report the 6 wildcat wells of 1942 are as follows: the two discovery wells in the Groton field (Fig. 1, N), described elsewhere in this report; Hanley and Bird's Frank Sleeve No. 1, Wayne Township, Steuben County (Fig. 1, No. 1) which encountered no oil, gas, or water in the Oriskany sand; New York State Natural Gas Company's Roger Lozier No. 1 (Fig. 1, No. 2), Troupsburg Township, Steuben County, which encountered no gas or water in the Oriskany sand; a location on the J. Gadsby farm by Allegany Gas Company in Bolivar Township, Allegany County (Fig. 1, No. 3), on which a rig was being built at the end of the year; and the same company's location on the Grace Conrad farm, Angelica Township, Allegany County (Fig. 1, No. 4).

Wildcat drilling for Oriskany gas in New York state is expected to increase. Proved reserves have been so depleted that an increase in exploratory drilling is practically required. Due to the decrease in reserves, the exchange of gas between companies, and OPM order M-68, many new locations are being made and drilled on the share-the-cost, acreage and production basis between two or more companies. These conditions should increase wildcat drilling and give each company participating a better chance per dollar of exploration money. This trend is probably one of the most important developments in recent years in the New York-Pennsylvania area and can be considered indirectly caused by, and an aid to, the war program.

Pennsylvania[3]

INTRODUCTION

During 1942 approximately the same number of wells were completed in the shallow gas territory of western Pennsylvania (Upper Devonian or higher) as during 1941. Outside those areas in which secondary-recovery operations are under way, there was very little drilling for oil throughout the year and no unusual developments occurred. Successful deep-drilling operations, as in 1941, were confined almost entirely to the Summit gas pool in Fayette County.

SHALLOW-SAND DEVELOPMENTS

GAS

Of the shallow wells drilled for gas, 80 per cent were producers and 20 per cent were dry. The 738 new gas wells had a total initial open-flow capacity of 240,353,000 cubic feet of gas per day.

Southwestern Pennsylvania.—Shallow-well completions in southwestern Pennsylvania are shown in Table I. The 410 new gas wells had a total initial open-flow capacity of 190,731,000 cubic feet of gas per day.

[3] Published by permission of the State geologist of Pennsylvania. The writers acknowledge the assistance of F. H. Finn, John T. Galey, and D. T. Secor, who contributed part of the data.

TABLE I

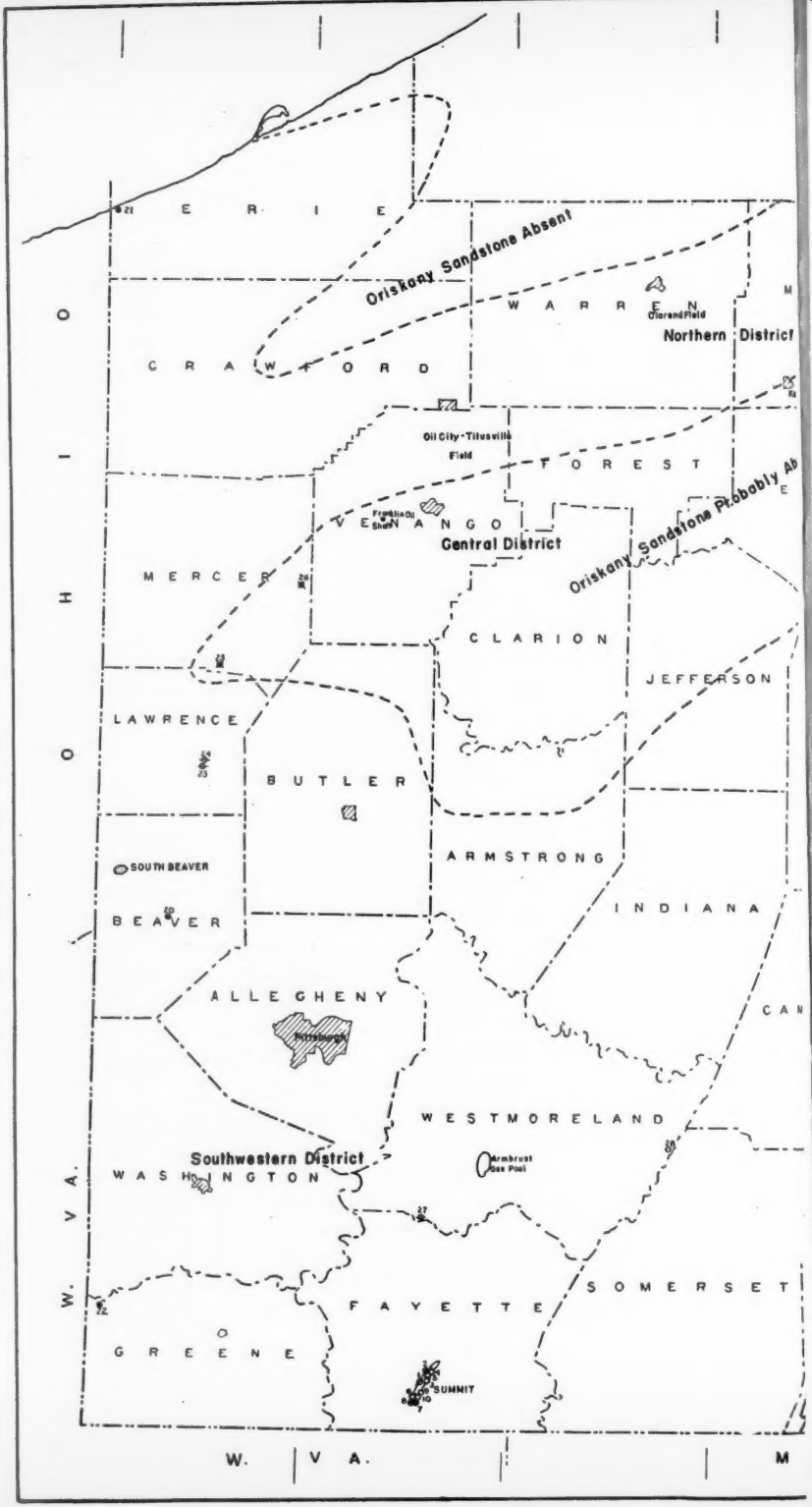
SHALLOW-WELL COMPLETIONS IN SOUTHWESTERN PENNSYLVANIA IN 1942

County	*Completions*		*Gas*			*Oil*			*Dry*	
	Number of Wells	*Average Total Depth (Feet)*	*Number of Wells*	*Average Initial O.F. M.C.F. per Day*	*Average Total Depth (Feet)*	*Number of Wells*	*Average Initial Production (Barrels per Day)*	*Average Total Depth (Feet)*	*Number of Wells*	*Average Total Depth (Feet)*
Allegheny	23	2,328	14	1,174	2,302	1	8	1,590	8	2,465
Armstrong	120	2,708	105	132	2,729	1	.5	1,391	14	2,644
Beaver	4	1,362	0	—	—	1	.25	1,193	3	1,416
Butler	47	1,819	18	101	2,130	15	1.2	1,455	14	1,808
Fayette	42	2,498	28	744	2,458	0	—	—	14	2,577
Greene	94	2,806	78	751	2,863	3	28.3	1,491	13	2,764
Indiana	48	2,941	29	682	2,688	0	—	—	19	3,326
Lawrence	2	689	2	342	689	0	—	—	0	—
Washington	69	2,257	41	313	2,141	9	4.6	2,178	19	2,546
Westmoreland (excl. of Armbrust)	40	3,112	34	292	3,125	0	—	—	6	3,035
Armbrust Pool Westmoreland Co.	73	2,100	61	500	2,100	0	—	—	12	2,100
Total	562	2,516	410	465	2,563	30	5.1	1,669	122	2,568

The Armbrust pool in Hempfield Township, Westmoreland County, opened in 1941, was the scene of greatest activity. The pool represents a stratigraphic-type accumulation in a lentil of Fifth sand (Upper Devonian) on the southeast flank of the Fayette anticline. At the end of 1942, 88 wells had been completed, of which 75 were producers and 13 dry holes. The wells proved about 2,200 acres to be productive. This probably represents the extent of the pool. The total initial open-flow capacity of the 75 wells was approximately 48,000,000 cubic feet of gas per day.

The Big Injun (Mississippian) sand field of western Fayette and eastern Greene counties continued to be the scene of considerable activity. In this area wells with initial open-flow capacities in excess of one million cubic feet of gas per day were reported as follows: one each in German, Menallen, and Nicholson townships, Fayette County, and six in Monongahela Township, Greene County. Outside this area, wells with initial open-flow capacities in excess of one million cubic feet per day were located as follows: three in Forward Township, Allegheny County; one in Red Bank Township, Armstrong County; two in Center, one in Jackson, one in Washington, and two in Wayne townships, Greene County; one in Washington and two in Young townships, Indiana County; one in Nottingham and one in Somerset townships, Washington County; and one in Bell Township, Westmoreland County,

Northern and central districts. —A summary of activities in the shallow-gas-sand territory of the northern and central districts during 1942 is given in Table II. The 328 new gas wells had a total initial open-flow capacity of 49,622,000 cubic feet of gas per day. The largest wells were located in Clearfield County. The 8 new gas wells reported from this county had an average initial open-flow capacity of 1,198,000 cubic feet of gas per day.


E R I E
Oriskany Sandstone Absent
W A R R E N
Clarendon Field
Northern District
C R A W F O R D
Oil City-Titusville Field
F O R E S T
V E N A N G O
Central District
Oriskany Sandstone Probably Ab
M E R C E R
C L A R I O N
J E F F E R S O N
L A W R E N C E
B U T L E R
A R M S T R O N G
SOUTH BEAVER
B E A V E R
I N D I A N A
A L L E G H E N Y
W E S T M O R E L A N D
Southwestern District
W A S H I N G T O N
Armbrust Gas Pool
F A Y E T T E
S O M E R S E T
G R E E N E
SUMMIT
O H I O
W. V A.
W. V A.

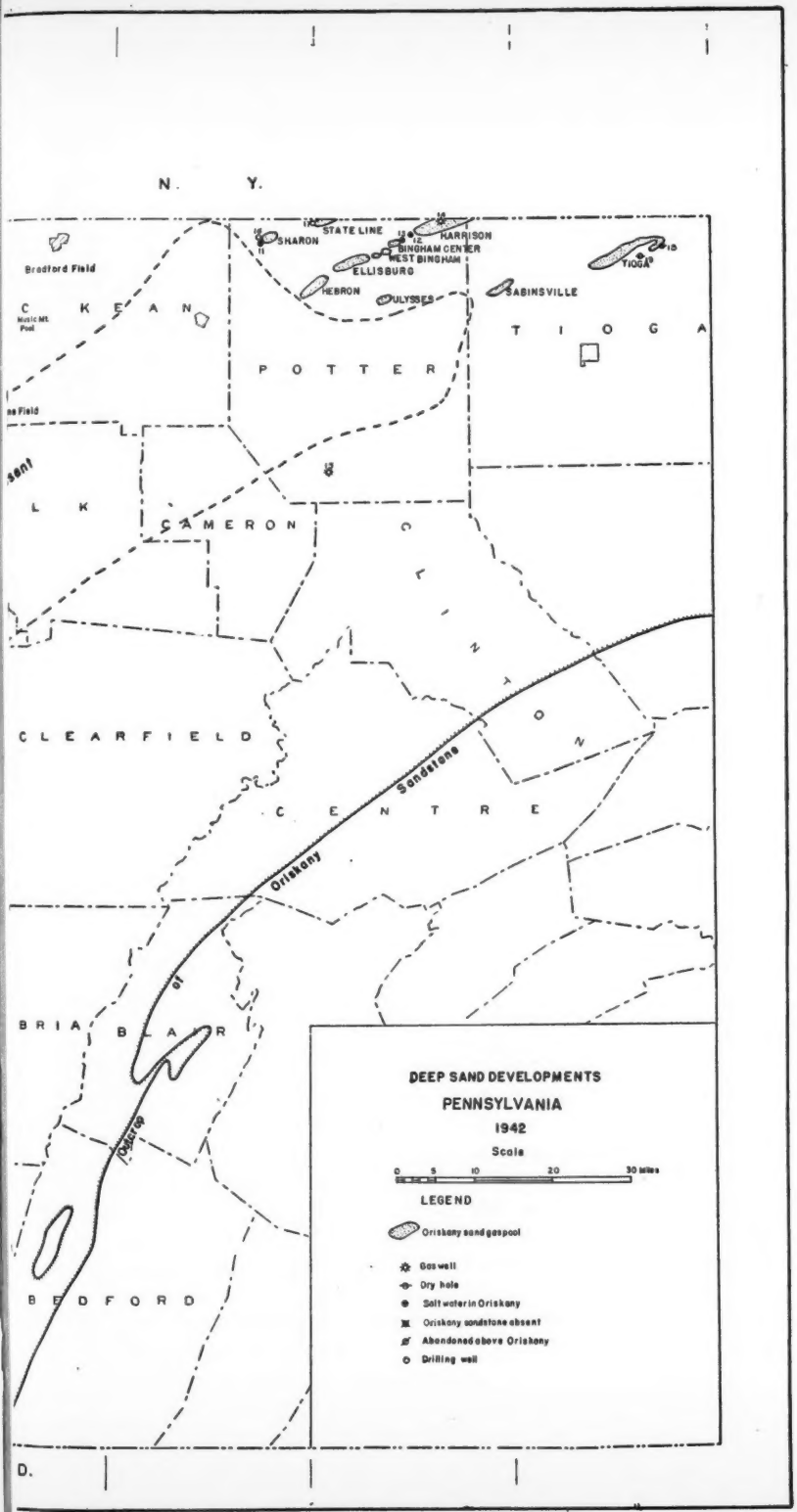

N. Y.
STATE LINE
SHARON
HARRISON
BINGHAM CENTER
WEST BINGHAM
ELLISBURG
HEBRON
ULYSSES
SABINSVILLE
TIOGA
Bradford Field
K E A N
P O T T E R
T I O G A
C A M E R O N
C L E A R F I E L D
C E N T R E
Oriskany Sandstone
B E D F O R D
DEEP SAND DEVELOPMENTS
PENNSYLVANIA
1942
Scale
0 5 10 20 30 Miles
LEGEND
Oriskany sand gaspool
Gas well
Dry hole
Salt water in Oriskany
Oriskany sandstone absent
Abandoned above Oriskany
Drilling well

FIG. 2

TABLE II

SHALLOW-WELL COMPLETIONS IN GAS FIELDS OF NORTHERN AND CENTRAL PENNSYLVANIA IN 1942

County	Completions		Gas			Dry	
	Number of Wells	Average Total Depth (Feet)	Number of Wells	Average Initial O.F. M.C.F. per Day	Average Total Depth (Feet)	Number of Wells	Average Total Depth (Feet)
Clarion	91	2,358	79	63	2,323	12	2,588
Clearfield	16	3,238	8	1,198	3,090	8	3,386
Elk	63	2,408	58	192	2,383	5	2,698
Forest	10	2,895	9	423	2,889	1	2,949
Jefferson	135	2,810	114	150	2,782	21	2,962
McKean	49	2,373	43	54	2,346	6	2,567
Venango	17	1,987	17	43	1,987	0	—
Warren	1	1,051	0	—	—	1	1,051
Total	382	2,559	328	151	2,513	54	2,838

OIL

Drilling for oil in areas outside those in which secondary-recovery operations are under way remained at a very low stage during 1942. In the Bradford field, 3,113 new wells were drilled, about half of which were intake wells. Production increased from a daily average of 38,350 barrels in 1941 to 42,555 barrels in 1942, or 11 per cent. The increase was due in part to the fact that a considerable number of projects developed in 1940 and 1941 did not come into production until 1942 because of delayed drilling of producing wells. The daily average production declined from a peak of 45,249 barrels in June to 40,024 barrels in December. The Bradford field accounted for 54.6 per cent of the total Pennsylvania grade crude-oil production of the Appalachian province in 1942. In the Kane-Clarendon area, where water-flooding operations are also under way, 126 wells were completed.

The daily average production of the Music Mountain pool, Lafayette Township, McKean County, declined from 1,775 barrels in January to 1,100 barrels in December. At the end of 1942, this pool, discovered in August, 1937, had produced 3,796,000 barrels of oil from 670 acres. In the central and southwestern oil districts of Pennsylvania, the daily average production declined from 11,501 barrels in 1941 to 10,196 barrels in 1942, or 11 per cent. In the Titusville-Oil City area, where secondary-recovery operations by means of air- and gas-drives are under way, about 340 new wells were drilled.

In the central district, the Venango Development Corporation, a syndicate in which several of the larger Pennsylvania oil companies are represented, undertook to recover oil by means of horizontal holes in the old Franklin heavy-oil pool (Venango First sand) at Franklin, Venango County. A circular shaft, 376 feet deep, lined with concrete and 8 feet in diameter in the clear, was completed

TABLE III

WELLS COMPLETED AND DRILLING IN SUMMIT POOL, FAYETTE COUNTY, PENNSYLVANIA, DURING 1942
(Depths are in feet)

Map Number	*Township*	*Well*	*Company*	*Elevation (Ft. above Sea-Level)*	*Tully*	*Top Onondaga Limestone*	*Top Chert*	*Oriskany*	*Total Depth*	*Date Completed*	*Results*
1	South Union	Carothers Est. No. 1	Wm. E. Snee & New Penn Dev. Corporation	2,569					7,092		Shut down above Tully, 12-18-41
2	South Union	Piedmont Coal Company No. 4	Peoples Nat. Gas Company	2,491	6,756–6,909	8,089	8,115		8,211	4-25-42	Salt water at 8,195; 8,204; 8,211
3	Wharton	O. J. Kirby *et al.* No. 1	Wm. E. Snee & New Penn Dev. Corporation	2,690	6,982–7,085	7,547	7,547	7,762	7,943	7-16-42	Gas at 7,583 and 7,588. 141 M. cu. ft. I.O.F.
4	Wharton	Leo F. Heyn No. 4	Wm. E. Snee & New Penn Dev. Corporation	2,531	6,000–6,100	6,484	6,504	6,648	6,722	10-14-42	Gas at 6,519; 6,525; 6,528; 6,530; 6,533. 11,875 M. cu. ft. I.O.F.
5	Wharton	Piedmont Coal Company No. 6	Peoples Nat. Gas Company	2,514	6,023–6,104	6,496	6,543		6,577	11-20-42	Gas at 6,554; 6,558; 6,564. 11,700 M. cu. ft. I.O.F.
6	Georges	Wm. R. Barton No. 1	Greensboro Gas Company	2,317	6,442–6,561	7,142	7,168		7,275	5- 9-42	Gas at 7,147; 7,237. 1,500 M. cu. ft. I.O.F. 3,275 lb. R.P.
7	Georges	Wm. R. Barton No. 2	Greensboro Gas Company	2,557		7,784	7,808		7,868	11- 9-42	Filled 6,000 ft. with salt water at 7,868
8	Georges	Wm. R. Barton No. 3	Greensboro Gas Company	2,451	6,507–6,590 6,781–7,021	7,584	7,631	7,798	7,810	1-19-43	Salt water at 7,810
					WELLS DRILLING						
9	Wharton	Indian Creek Coal & Coke Co. No. 2	Wm. E. Snee & New Penn Dev. Corporation	2,674							Drilling
10	Georges	George Walters No. 1	Peoples Nat. Gas Company	2,583							Drilling

TABLE IV

ORISKANY SAND WELLS COMPLETED AND DRILLING IN NORTH-CENTRAL PENNSYLVANIA DURING 1942
(Depths are in feet)

POTTER COUNTY

Map Number	*Township*	*Well*	*Company*	*Elevation (Feet above Sea-Level)*	*Tully*	*Onondaga*	*Oriskany*	*Total Depth*	*Date Completed*	*Results*
11	Sharon	R. M. Wolcott No. 1	Hanley & Bird and Allegany Gas Company	2,054	4,325–4,385	4,854–4,913	4,913–	4,918	10-7-42	Salt water at 4,918. Filled 425 feet in 14 hours
12	Bingham	C. H. Webster No. 1	Hanley and Bird	2,169	4,635–4,680	5,290–5,333	5,336–	5,343	5-26-42	Salt water at 5,340. Filled 320 feet over night
13	Bingham	R. L. Holbert No. 1	Hanley & Bird and Allegany Gas Co.	2,011	4,492–4,544	5,131–5,163	5,163–	5,183	10-5-42	Gas, 5,166–5,173. 185 M. cu. ft. I.O.F. after shot. Salt water at 5,182
14	Harrison	S. W. Berry No. 2	Allegany Gas Co.	2,159	4,386–4,427	5,057–5,089	5,089–	5,112	1-9-43	Gas, 5,094–5,112. 200 M. cu. ft. I.O.F. after shot
15	Wharton	Central Penn'a Lumber Co. No. 4	Godfrey L. Cabot, Inc.	2,001	5,580–5,644	6,297–6,313	6,313–6,346	6,348	5-7-42	Gas, 6,322–6,325. 808 M. cu. ft. I.O.F. after shot. 3,200 lb. R.P.
16	Sharon	Mary White No. 1	Allegany Gas Co.		4,341–4,389					Drilling
17	Oswayo	Margaret Coyle No. 1	D.Y.M. Corp.	2,113	4,301–					Drilling
			TIOGA COUNTY							
18	Lawrence	Lawrenceville Bank No. 3	Allegany Gas Co.	1,027	2,536–2,604	3,561–3,585	3,585–3,630	3,646	8-3-42	No gas or salt water in Oriskany
19	Tioga	Aaron Van Druff No. 1	Allegany Gas Co.	1,686	3,629–3,700	4,605–4,629	4,629–4,670	5,154	9-24-42	No gas or salt water in Oriskany. Salt 5,128–5,154

TABLE V

Deep Tests Completed and Drilling in Western Pennsylvania during 1942

(Depths are in feet)

Map Number	County	Township	Well	Company	Elevation (Feet above Sea-Level)	Tully	Onondaga	Oriskany	Lockport	Medina	Top Trenton	Total Depth	Date Completed	Results
20	Beaver	Center	J. P. Koehler Estate	St. Joseph Lead Company	1,072		5,145–5,312	5,312–				5,345	2-12-42	½ bbl. salt water per hour, 5,319–5,330
21	Erie	Springfield	N. Blickensderfer No. 1	Ohio Oil Co.	642		1,378–1,652	1,652–1,682		2,618–2,750	4,397	4,457	4-10-42	Hole full salt water, 1,652. Salt water, 2,422–2,431. Showing gas, 2,652. Sulphur water, 4,457, rose 300 feet per hr.
22	Greene	Richhill	S. G. Alley No. 1	Manufacturers Light & Heat Co.	1,246		6,776–	7,016–				7,118	3-27-42	1½ bailers salt water per hour at 7,034
23	Lawrence	Slippery Rock	Laura M. Miller & H. F. Myers No. 1	T. W. Phillips Gas & Oil Co. and John T. Galey	1,207		4,506–4,674	4,674–4,714				4,737	6-21-42	Showing gas, 4,685–4,686. Showing amber oil
24	Lawrence	Slippery Rock	Frederick G. & C. C. Hill No. 1	T. W. Phillips Gas & Oil Co.	1,197		4,485–4,661	4,661–4,690				6,360	12-31-42	Well drilled through Lockport. Showing gas, 4,666 and 5,970
25	Mercer	Springfield	S. H. Collins No. 12	E. A. Bream Co.	1,289		4,280–4,424	No sand	5,500–5,753			5,835	8-7-42	A very little gas at 4,525. A little gas and very little water at 5,710
26	Mercer	Worth	Earl B. Minnis No. 1	United Nat. Gas Company	1,394	3,820–3,875	4,030–4,168	No sand	5,036–5,358			5,688	11-13-42	Showing gas, 4,258; 5,293–5,316. 160 M. cu. ft. I.O.F.
27	Westmoreland	South Huntingdon	Jacobs Creek Oil Co. No. 1	Peoples Nat. Gas Company	964	6,720–6,736	7,317–7,902	7,902–7,982				8,080	8-11-42	Showing of gas at 7,982
28	Westmoreland	Ligonier	John Beck No. 1	Wm. E. Snee & New Penn Dev. Corporation	2,785	6,858–								Drilling at 7,276

to the top of the sand during 1942. Here the hole was expanded, eccentrically, forming a chamber in the sand, 60 feet high and 27 feet in diameter. This has been lined with concrete also. It is planned to drill horizontal holes with a diamond drill from the chamber radially outwards into the sand. Only small amounts of oil and water seeped into the chamber from the sand and there was practically no gas.

The exposure of the oil sand, even though it was partially depleted by near-by oil wells, afforded an opportunity for many interesting geological observations. The U. S. Bureau of Mines obtained large samples of the oil sand for analysis. Parke A. Dickey of the Pennsylvania Geological Survey made several electrical logs of the sand and found the natural or "porosity" potential differences present between the sand and the shales although no water had ever been in contact with the sand face. The Pennsylvania State College took samples of the rock for bacteriological study.

DEEP-SAND DEVELOPMENTS

Summit gas pool, Fayette County.—During 1942 seven wells were completed in the Summit gas pool, opened in 1936. One was abandoned above the Tully limestone after passing through a fault and two were drilling at the close of the year. The new work is summarized in Table III. Of the seven wells completed, four were producers and three encountered salt water. The new wells did not extend the productive area of the pool. Recent deep drilling has revealed that the elongate dome on which the pool is located, with a closure of approximately 1,000 feet as mapped on the surface beds, is complexly faulted in depth.

Oriskany gas fields of north-central Pennsylvania.—Seven wells were completed in the Oriskany gas fields of north-central Pennsylvania during 1942, as shown in Table IV, and two were drilling at the close of the year. Of the five wells completed in Potter County, two were small gas wells—one located in the northern part of the Harrison pool and the other in Wharton Township in the southern part of the county. No extension of productive areas occurred. The other three wells—one located near the southwestern margin of the Sharon pool and two near the northeastern margin of the Bingham Center pool—encountered salt water in the Oriskany sand.

Of the two wells completed in Tioga County, the Van Druff No. 1 represents an unsuccessful attempt to locate a detached fault block south of the Tioga field. The other well, the Lawrenceville Bank No. 3, is located near the eastern margin of the Tioga field. No gas or salt water was encountered in the Oriskany sandstone in either well.

Other deep tests.—The results of deep drilling during 1942 in western Pennsylvania outside the producing areas are summarized in Table V. Of the eight wells completed, only one, located in the eastern part of Mercer County, is a small gas producer in the Lockport dolomite. The others were dry holes. Although salt water and occasional good showings of both gas and oil have been reported

in the Lockport dolomite in wells in northwestern Pennsylvania at a horizon that may correspond with the Newburg sand of Ohio, this is the first well to encounter gas in commercial quantity. The two wells completed in Mercer County during 1942 failed to find any sand at the Oriskany horizon, thereby extending the area in which the Oriskany is absent into southeastern Mercer County. A well in the northwestern corner of Erie County was abandoned in the upper part of the Trenton limestone after encountering a showing of gas and considerable salt water in it.

OHIO

Only 998 tests were completed in Ohio during the year. This was 563, or 36 per cent, less than the total drilled during 1941. Of these, 454 were gas wells, 194 were oil wells, and 350, or 35 per cent, were dry.

A total initial open-flow volume of 306,437 M.C.F. of gas was developed from all sands and, in addition, 8,735 M.C.F. of casing-head gas from nine oil wells and 1,274 M.C.F. from 17 old wells drilled deeper, making an initial volume of 316,446 M.C.F. daily capacity for new gas developed in the state. The preliminary estimate for gas produced during the year is 41,858,000 M.C.F.

Oil produced in Ohio is of four grades, Pennsylvania, Corning, Chatham, and Lima. A total of 3,663,872 barrels was produced in the state, of which 1,751,566 barrels were of Pennsylvania grade. The production of Pennsylvania grade, which sold for $2.55, increased 16 per cent over that of 1941. Corning grade sold for $1.31; consequently its production declined 7 per cent.

Relatively few outlying tests were drilled and no new fields of importance were discovered. The greatest drilling activity was in Perry County where 62 Clinton oil wells were completed with a total initial daily capacity of 5,265 barrels of Pennsylvania grade oil.

The drilling in Ohio is summarized by counties and sands and by sands in the two following tables.

WELLS COMPLETED IN OHIO IN 1942
SUMMARY BY COUNTIES AND SANDS

County	*Sand*	*Gas Wells*	*Initial Open Flow (M.C.F.)*	*Oil Wells*	*Initial Production (Barrels)*	*Dry*	*Total*
Ashland	Berea			2	13	3	5
	Clinton	19	11,217	0	0	17	36
		19	11,217	2	13	20	41
Athens	Shallow	10	4,201	6	30	12	28
	Berea	7	3,681	0	0	12	19
	Clinton	1	560	1	30	1	3
		18	7,175	7	60	25	50
Anglaize	Trenton	0	0	0	0	1	1
Belmont	Berea	4	163	0	0	1	5

WELLS COMPLETED IN OHIO IN 1942
SUMMARY BY COUNTIES AND SANDS

County	*Sand*	*Gas Wells*	*Initial Open Flow (M.C.F.)*	*Oil Wells*	*Initial Production (Barrels)*	*Dry*	*Total*
Carroll	Berea	0	0	2	4	2	4
Columbiana	Berea	2	132	1	2	6	9
Coshocton	Berea	2	124	0	0	0	2
	Clinton	7	4,996	4	213	12	23
		9	5,120	4	213	12	25
Cuyahoga	Oriskany	4	9,306	0	0	0	4
	Newburg	1	400	0	0	0	1
	Clinton	1	184	0	0	2	3
		6	9,890	0	0	2	8
Fairfield	Clinton	8	721	0	0	1	9
Fulton	Trenton	0	0	0	0	1	1
Gallia	Berea	3	168	0	0	1	4
	Clinton	1	5,050	0	0	0	1
		4	5,218	0	0	1	5
Greene	Sub-Trenton	0	0	0	0	1	1
Guernsey	Shallow	1	1,000	0	0	0	1
	Berea	3	93			3	6
	Oriskany	5	7,280	0	0	1	6
		9	8,373	0	0	4	13
Hancock	Trenton	0	0	1	1	0	1
Harrison	Berea	0	0	0	0	1	1
Highland	Sub-Trenton	0	0	0	0	1	1
Hocking	Shallow	2	800	0	0	0	2
	Berea	1	423	0	0	1	2
	Ohio Shale	1	18				
	Clinton	0	0	2	60	1	3
		4	1,241	2	60	2	7
Holmes	Berea	1	68	0	0	1	2
	Clinton	15	14,812	1	20	14	30
		16	14,880	1	20	15	32
Jackson	Shallow	1	21	0	0	0	1
Jefferson	Berea	0	0	1	1	5	6
Knox	Berea	2	120	0	0	2	4
	Clinton	17	7,951	3	143	28	48
		19	8,071	3	143	30	52
Lawrence	Shallow	1	230	0	0	0	1
	Ohio Shale	3	501	0	0	0	3
	Clinton	3	6,163	0	0	1	4
		7	6,894	0	0	1	8

WELLS COMPLETED IN OHIO IN 1942
SUMMARY BY COUNTIES AND SANDS

County	*Sand*	*Gas Wells*	*Initial Open Flow (M.C.F.)*	*Oil Wells*	*Initial Production (Barrels)*	*Dry*	*Total*
Licking	Berea	3	403	4	20	0	7
	Shale	1	143	0	0	0	1
	Clinton	20	5,887	6	306	9	35
		24	6,433	10	326	9	43
Lorain	Clinton	15	18,423	0	0	15	30
Mahoning	Berea	0	0	8	19	0	8
Medina	Berea	0	0	14	311	5	19
	Clinton	31	41,435	6	434	12	49
		31	41,435	20	745	17	68
Meigs	Shallow	33	11,127	1	1	17	51
	Berea	8	4,604	2	8	4	14
	Ohio Shale	1	35	0	0	1	2
		42	15,766	3	9	22	67
Mercer	Trenton	0	0	4	85	0	4
Monroe	Shallow	4	702	10	281	8	22
	Berea	11	520	0	0	2	13
		15	1,222	10	281	10	35
Morgan	Shallow	7	6,880	5	9	10	22
	Berea	19	3,333	0	0	1	20
	Oriskany	0	0	0	0	1	1
	Clinton	17	40,523	0	0	11	28
		43	50,736	5	9	23	71
Muskingum	Clinton	30	18,398	7	761	15	52
Noble	Shallow	6	2,814	3	10	9	18
	Berea	12	1,158	1	2	7	20
		18	3,972	4	12	16	38
Ottawa	Trenton	0	0	1	1	1	2
Perry	Shallow	1	160	0	0	0	1
	Berea	7	1,125	5	25	3	15
	Newburg	1	700	0	0	0	1
	Clinton	9	10,789	62	5,265	22	93
		18	12,774	67	5,290	25	110
Putnam	Trenton	0	0	1	5	0	1
Richland	Clinton	0	0	0	0	1	1
Seneca	Trenton	0	0	0	0	3	3
	Sub-Trenton	0	0	0	0	2	2
		0	0	0	0	5	5
Stark	Clinton	12	14,991	0	0	7	19
Summit	Newburg	2	2,323	0	0	1	3
	Clinton	8	2,942	1	20	4	13
		10	5,265	1	20	5	16

WELLS COMPLETED IN OHIO IN 1942
SUMMARY BY COUNTIES AND SANDS

County	*Sand*	*Gas Wells*	*Initial Open Flow (M.C.F.)*	*Oil Wells*	*Initial Production (Barrels)*	*Dry*	*Total*
Trumbull	Clinton	0	0	0	0	1	1
Tuscarawas	Clinton	23	9,568	0	0	4	27
Vinton	Berea	1	6	0	0	3	4
	Clinton	1	1,310	0	0	2	3
		2	1,316	0	0	5	7
Washington	Shallow	18	2,683	20	99	16	54
	Berea	4	158	2	7	4	10
	Ohio Shale	0	0	0	0	1	1
	Oriskany	0	0	0	0	1	1
		22	2,841	22	106	22	66
Wayne	Berea	1	120	0	0	1	2
	Newburg	1	492	0	0	0	1
	Clinton	21	23,662	2	115	7	30
		23	24,274	2	115	8	33
Wood	Trenton	0	0	5	87	3	8
	Sub-Trenton	0	0	0	0	1	1
		0	0	5	87	4	9
Wyandot	Sub-Trenton	0	0	0	0	3	3
Total		454	306,437	194	8,386	350	998

WELLS COMPLETED IN OHIO IN 1942
SUMMARY BY SANDS

Sand	*Number of Tests*	*Gas*	*Initial Open Flow (M.C.F.)*	*Oil*	*Initial Production (Barrels)*	*Dry*	*Percentage*
Shallow	201	84	30,618	45	430	72	36
Berea	200	91	15,132	42	412	67	33
Ohio Shale	8	6	697	0	0	2	25
Oriskany	12	9	16,586	0	0	3	25
Newburg	6	5	3,915	0	0	1	17
Clinton	542	259	239,489	95	7,365	188	35
Trenton	21	0	0	12	179	9	43
Sub-Trenton	8	0	0	0	0	8	100
Total	998	454	306,437	194	8,386	350	35

WEST VIRGINIA

During the year, drilling activity, as reported by the West Virginia Department of Mines, was as follows, the figures not being complete as yet (Feb. 4, 1943) and subject to minor revision.

Total wells drilled	758
Gas wells	514
Oil wells	73
Combination oil and gas wells	20
Brine wells	2
Dry holes	149
Gas wells abandoned	300
Oil wells abandoned	430
Combination oil and gas wells abandoned	23
New oil volume developed (barrels)	2,234

By the end of the year, the Oriskany sand gas field of Kanawha and Jackson counties (Elk-Poca and Sandyville fields) had been well defined, operations being confined largely to edge drilling. Wells, located and drilling, numbered about 55 in contrast to perhaps twice that number early in the year. The field as now defined covers about 125,000 acres.

In the Oriskany sand fields, all in Kanawha and Jackson counties, that is, Campbells Creek, Elk-Poca and Sandyville, 197 gas wells were completed with total new initial open flow of 1,011,096,000 cubic feet. This was divided as follows, the last two-named fields being one continuous field.

	Wells	*M. Cu. Ft.*
Campbells Creek	1	179
Elk-Poca	118	538,293
Sandyville	78	472,624
Totals	197	1,011,096

In addition to the foregoing, 32 Oriskany sand dry holes were completed, 14 in Jackson County, 8 in Kanawha County, 2 in Boone County, and 1 in each of the following counties: Wood, Roane, Putnam, Mason, Ritchie, Tyler, Wirt, and Lewis.

In drilling to depths below the Oriskany sand, there was activity in only four instances. In the north edge of Boone County, which is the extreme southwest edge of the Campbells Creek Oriskany sand field, a well near the crest of the Warfield anticline encountered a new gas "pay" (100,000 cubic feet and rock pressure of perhaps 2,000 pounds) in sand at 4,802–4,808 feet. This is 135 feet above the Newburg sand which was found at 4,937–4,954 feet. The sand is a tan to brown, loose, fine- to medium-grained dolomite-anhydrite rock in which numerous large clear dolomite crystals and well developed small quartz crystals were noted. Lower in the sand body at 4,918 feet some sulphur water was found, this apparently being separated from the gas "pay" by a higher percentage of dark brown shale, as the dolomite-anhydrite rock was essentially of the same character as the pay sand. Scattered through this sand were small fluorite crystals.

The nomenclature committee of the Appalachian Geological Society has named this formation the Bull Creek sand, from the stream near which the well is located. Drilling was continued to the Newburg horizon as already noted (the new "pay" having been lost due to the water found below it) and was completed

as a Newburg sand gas well, open flow being 119,000 cubic feet and rock pressure 2,000 pounds.

In Wayne County two wells were drilled through the Corniferous limestone and on through the Helderburg, to what corresponds with the Big Six sand of eastern Kentucky, directly beneath the limestone. Both were small gas wells, 75 M and 130 M, with rock pressure of about 1,350 pounds, and total depth of about 4,000 feet. While such open flow amounts are not of great consequence, the important features are the presence of the sand in this area and the high rock pressure shown.

The Oriskany sand dry hole in Ritchie County was drilled on into the Newburg sand, water being present as at the Oriskany level. The total depth of this well was 7,325 feet. In Mason County the Oriskany sand dry hole was drilled through the Newburg, and early in 1943 through the Clinton sand and a part of the Red Medina. No oil or gas was found.

About the flanks of the Burning Springs arch, four Oriskany sand dry holes were completed during the year. One of these had a gas showing in the sand, the other three found water. The final well of this group, in Pleasants County, was completed early in 1943. This apparently makes it very doubtful that there is any chance of Oriskany production on this structure, as at least the upper 2,000 feet of the arch has been proved dry or, in large part, salt-water bearing.

The most interesting of current drilling at year's end was the deep test drilling in Tucker County, located on a very pronounced structure, but far to the east, in a structural sense, of any presently known production; also the drilling in Wyoming and Raleigh counties in the southern part of the state. Two shallow sand gas wells have resulted and two interesting Oriskany sand tests were drilling.

In the shallow-sands districts, that is, in all sands above the Oriskany, there was no discovery of importance. Various worthwhile extensions of known productive areas were opened, as in the Big Lime-Big Injun zones of Clay County.

Eastern Kentucky

A large percentage of the drilling in the area east of the Cincinnati arch for the past year has been in the search for, and the development of, gas reserves. An estimated 240 gas wells, 18 oil wells, and 50 dry holes have been drilled in 23 counties. The new oil reserves were very small, but this area produced approximately 1,808,000 barrels of oil from stripper wells.

As a result of the modification of Federal regulations for the spacing of gas wells, development was not materially curtailed. The necessity for obtaining exceptions to these regulations in the spacing of oil wells in areas where the reservoir pressures are depleted, coupled with the low price of crude oil, has resulted in the drilling of very few tests in the oil-producing areas. Very few wildcat wells have been drilled for oil and the drilling for gas has been mainly in proved or semi-proved areas.

There is little doubt that the low price of oil is very largely responsible for the decrease in drilling operations, and as a result, the additions to oil reserves in eastern Kentucky have been retarded at a time when they are sorely needed. The need for additional gas reserves in eastern Kentucky is particularly acute at this time, for its geographic location makes it highly desirable to bolster the dwindling reserves caused by excessive wartime withdrawals.

Tennessee East of Cincinnati Arch[4]

The production of crude oil east of the Cincinnati arch during 1942 was approximately 11,000 barrels, the smallest since 1934. The greater part of the production was from the Mississippian limestone pools in Scott and Morgan counties. Half a dozen wells in the Upper Cumberland district, pumped intermittently, produced about 1,000 barrels. Natural gas was marketed from wells in Morgan and Fentress counties for consumption in the Sunbright and Jamestown areas, respectively.

There were only six completions during the year east of the Cincinnati arch, totaling 11,098 feet. Of the six completions, two were gas wells in the proved area south of Jamestown and four were dry holes. The well reported last year northwest of Oneida in Scott County was acidized and probably will be a commercial producer from a depth of 935–965 feet.

The Stanolind Oil and Gas Company's test in Putnam County was the most significant test in 1942. This well, located on a well defined surface structure, was abandoned in the upper part of the Knox dolomite group at 2,130 feet. A showing of oil was logged in the Knox at 1,653–1,661 feet.

The most active leasing in the area continued to be in the northern part of the Cumberland Plateau especially in Cumberland, Morgan, and Scott counties.

[4] Published with the permission of the State Geologist.

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DEVELOPMENTS IN ROCKY MOUNTAIN REGION IN 1942[1]

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ABSTRACT

Drilling activities in the Rocky Mountain region on the basis of wells making footage were 83 per cent in number and made 87 per cent of the footage of 1941. Oil and gas production increased about 8 per cent. Discoveries in Wyoming were more important than any since 1938, with the completion of large oil wells in the previously untested Tensleep sandstone at Elk Basin, and Pilot Butte; Lakota, and possibly Muddy sand oil production at Horse Creek; gas wells at Sherard; and other lesser discoveries. Minor discoveries were made in Montana. Prospecting in Colorado, North Dakota, South Dakota, northwestern New Mexico, and Utah was less successful. Extensions of known fields were not important in developing new reserves. The number of wildcat wells in operation declined 25 per cent. Pipe-line activity consisted of a few extensions, replacements, and short gas lines.

INTRODUCTION

Five hundred and one wells were in drilling status in Colorado, Montana, Utah, and Wyoming in 1942, as compared with 603 in 1941 and 601 in 1940. The total footage drilled was 1,065,820 feet in 1942, 1,221,547 feet in 1941, and 1,142,011 feet in 1940. Of the wells drilling, 412 were in oil and gas fields, including a few discovery or wildcat wells, 81 were listed as wildcats, and the balance as miscellaneous and deepening operations. In 1941, 108 wildcats were drilling. These figures include all wells making any footage, such as new starts and completions, continuations, and deepening jobs. Statistics for other states in or near the Rocky Mountain region have not been compiled by the writer, but important operations are discussed.

Among 34 operations in Colorado fields, 12 oil wells were completed at Hiawatha (East), Rangely, and Wilson Creek; 1 gas well at Powder Wash; 14 were drilling or suspended at the end of the year; and 7 were abandoned. Among 242 operations in Montana fields, 123 oil wells were completed, mainly at Cut Bank and Kevin-Sunburst; 69 gas wells, mainly at Bowdoin and Cedar Creek (Baker-Glendive); 29 were drilling or suspended at the end of the year; and 21 were abandoned. Among 136 operations in Wyoming fields, 106 oil wells and 6 gas wells were completed in 25 fields, with South Oregon Basin, Lance Creek, and Circle Ridge leading with a total of 50, and Byron, Cole Creek, Frannie, La Barge, North Oregon Basin, Pilot Butte, and Wertz having 5 or 6 wells each. Only two wells within Wyoming fields, exclusive of wildcats, were listed as failures, and 22 were drilling or suspended at the end of the year. The breakdown of wildcats is discussed in detail under "Important Dry Holes."

[1] Presented by title before the Association at Fort Worth, April 7–9, 1943. Manuscript received, April 9, 1943. Published by permission of the director of the Geological Survey.

[2] Geological Survey, United States Department of the Interior.

NEW DISCOVERIES

MONTANA

Conrad Butte.—R. C. Tarrant's McCracken No. 1 in the SE. ¼, NW. ¼ Sec. 12, T. 29 N., R. 1 W., reported 1,000,000 cubic feet of gas in the Colorado shale (Upper Cretaceous) at 715–740 feet, but the pressure was negligible.

Conrad-Midway.—Three wells also drilled by Tarrant were suspended at the end of the year, although two of them received mention as discoveries. Wood No. 1 in the NE. ¼, NW. ¼ Sec. 32, T. 28 N., R. 1 W., showed oil in the Sunburst sand of the Kootenai formation (Lower Cretaceous) at 1,690 feet, but was continued 105 feet into the Madison limestone (Lower Mississippian) which was topped at 1,950 feet, but it was water-bearing. De Staffany No. 1 in the NW. ¼, NE. ¼ Sec. 30, averaged 2 barrels of 42.6° A.P.I. gravity oil per day on test of the Sunburst sand at 1,725–1,745 feet. Anderson No. 1 in the NE. ¼, SE. ¼ Sec. 26, T. 28 N., R. 2 W., was suspended at 1,440 feet in the Kootenai formation.

Fred and George Creek nose (Apex).—The A. A. Oil Corporation's No. 1 in the SW. ¼, SW. ¼ Sec. 22, T. 37 N., R. 2 E., reported 2,000,000 cubic feet of gas and 200 pounds of shut-in pressure in the Blackleaf sandy member of the Colorado shale at 1,510–1,525 feet. A previous gas well in this township was drilled in 1915 on the Pritchard Nose in the NE. ¼, SE. ¼ Sec. 4, and other small gas and oil fields are present in the Sweetgrass Hills region.

Twin Rivers nose (Reagan).—Ed Reagan's Tribal No. 2 in the NW. ¼, NE. ¼ Sec. 27, T. 37 N., R. 7 W., was completed as an oil well in September, 1942, with an initial production of 85 barrels of 36.4° A.P.I. gravity oil. The top of the Madison limestone was at 3,816 feet, and the oil zone at 3,880–3,905 feet. Tribal No. 1 in the SE. ¼, NE. ¼ Sec. 22, completed as a small gas well higher in the Madison in 1941, cemented off the gas zone late in 1942, and was awaiting testing in the deeper oil zone.

WYOMING

Big Piney.—Gas was reported in three wells drilled in Ts. 29 and 30 N., R. 113 W., in accord with previous showings in the Wasatch formation (lower Eocene). One well was suspended as a gas well and the others as incomplete. Structural conditions are uncertain, but a large amount of gas would be required to warrant distant market use.

Horse Creek anticline.—A discovery which redirected attention to southeastern Wyoming and northeastern Colorado was the General Petroleum Corporation's Saltgaver No. 78 in the SE. ¼, SE. ¼ Sec. 31, T. 17 N., R. 68 W., drilled to a depth of 5,530 feet into the Morrison formation (Upper Jurassic) on a seismic "high." The Muddy sand (Upper Cretaceous) at 5,264–5,290 feet was saturated but tight, the Dakota sandstone (Upper Cretaceous) at 5,419–5,450 feet was dry, but the Lakota sandstone (Lower Cretaceous) at 5,451–5,515 feet was productive. The well produced 7,000 barrels of 30° A.P.I. gravity

oil and 10,000 barrels of water in a 2-month period late in the year, but at the end of the test, the water content was more than 75 per cent. A second well was drilled ½ mile south, which was directed toward the Sundance formation (Upper Jurassic) at the end of the year, but early in 1943, being unsuccessful there, was being further tested in the Muddy sand, 190 feet lower than in the discovery well, but more favorable in permeability.

Northern Hiawatha.—The Vermillion Oil Company's Watson No. 1, in the NE. ¼, NE. ¼ Sec. 6, T. 12 N., R. 99 W., tested 10–12 barrels daily of 37° A.P.I. gravity oil from the Wasatch formation at 2,630–2,647 feet, after plugging back from a gas sand at 3,310–3,325 feet and total depth of 3,470 feet. This well is 2 miles northeast from the nearest gas well on the Hiawatha (East) dome, but whether it is on a separate structure is not known.

Sherard dome.—The Sinclair-Wyoming Oil Company's Carter No. 1, in the SE. ¼, SE. ¼ Sec. 31, T. 25 N., R. 88 W., on the south "high" of a seismic structure, had drill-stem tests of the Frontier, Dakota, and Lakota sands in the fall of 1941, but was continued to 5,185 feet in the Tensleep sandstone (Pennsylvanian) by March, 1942. This sand was tight and water-bearing, a disappointment in view of its productivity in the neighboring Lost Soldier district. The well was plugged back to the Lakota gas sand at 2,955–2,980 feet with an initial volume of 8,080,000 cubic feet and shut-in pressure of 1,050 pounds. A second well on the north "high" had a large flow of warm water in the Tensleep sandstone topped at 4,966 feet, and was completed as a Frontier sand gas well at 2,315–2,330 feet. A third well was drilled to the Lakota gas sand on the south "high."

Sulphur Creek.—Wy-Ut Associates, Incorporated, Bate No. 1 in the SE. ¼, SW. ¼ Sec. 14, T. 13 N., R. 119 W., tested 15–25 barrels daily of 17.1° A.P.I. gravity oil from the Bear River formation (?) (Upper Cretaceous), at the total depth of 686 feet, but was suspended as incomplete for the winter.

DEEPER PRODUCING ZONES IN OLD FIELDS

WYOMING

Elk Basin.—The most important discovery in the region was of 30° A.P.I. gravity oil in the Tensleep sandstone in the Minnelusa Oil Corporation's Henderson No. 1-ET in the NE. ¼, NE. ¼ Sec. 31, T. 58 N., R. 99 W. This field has produced light oil from the Frontier formation (Upper Cretaceous) since 1916 and gas from the Cloverly formation (Lower Cretaceous) since 1920, but had not been drilled to the zones producing black oil.

The top of the Tensleep was at 4,494 feet and the total depth at 4,538 feet. Some saturation was reported in the superjacent Embar formation (Permian and Triassic), which was cased off. The oil is the highest quality produced in any of the black oil fields of the Big Horn Basin. The initial productive capacity was more than 2,500 barrels a day.

Pilot Butte.—The British American-Superior Oil Company's Tribal No. 1, in the SW. ¼, SW. ¼ Sec. 15, T. 3 N., R. 1 W., had an initial production of 714

barrels a day of 26.1° A.P.I. gravity oil from the Tensleep sandstone at 6,183–6,325 feet. This accelerated drilling activities, and two other Tensleep producers were completed. A fourth well, completed in the Embar formation, had gone largely to water at the end of the year, causing a fifth well to be shut down for the winter. A sixth well was unsuccessful in the Tensleep, and was completed as a gas well in the Muddy sand at 3,293–3,300 feet. This field has produced oil from the Cody shale (Upper Cretaceous) since 1916, and has been capable of gas production from the Muddy sand since 1931; therefore, the new gas well served only to extend the gas area one mile south from the discovery gas well.

Shoshone.—The Husky Refining Company's Stump No. 2, in the SW. ¼, NW. ¼ Sec. 21, T. 53 N., R. 101 W., was completed as an Embar-Tensleep producer of 18.9° A.P.I. gravity oil at the total depth of 4,795 feet. Shallow wells in this field in 1910 and 1915 found oil in the Muddy and Frontier sands, and two wells completed in 1929 and 1930 were Embar producers, but were abandoned in 1931. The Embar formation was reopened in 1938 by the deepening of Stump No. 1. It is questionable whether any of the previous wells drilled the Tensleep sandstone, and Stump No. 2 is recognized as the first Tensleep producer.

EXTENSIONS TO OLD FIELDS

Developments in fields, except those heretofore mentioned, added little to the oil and gas reserves, although the available potential was increased. Extensions have been noted on the basis of additional tracts or subdivisions, among which are Wilson Creek, Colorado, Circle Ridge, Mahoney and Wertz, Wyoming, and others. These and other field activities, however, were within the probable productive limits previously established.

COLORADO

The Mountain Fuel Supply Company's Allen No. 2, in the NE. ¼, NW. ¼ Sec. 32, T. 12 N., R. 97 W., in the Powder Wash field, was completed as a gas well at the total depth of 4,006 feet, ½ mile north and east of the two nearest producers. This, together with a 5,700-foot dry hole and two gas wells completed in 1941, had the general effect of moving the productive area northeast, with some arbitrary enlargement not predicated on known contours. Two gas wells were deepened to lower zones.

MONTANA

The Glacier Production Company's McGuinness No. 1, in the center, NW. ¼ Sec. 8, T. 35 N., R. 5 W., in the gas area of the Cut Bank field, was reported to have flowed 735 barrels a day of 47.6° A.P.I. gravity oil from the upper Sunburst or Moulton sand of the Kootenai formation at 2,856–2,891 feet. At Kevin-Sunburst, an extension well of the Washington Oil Finding Company in the NE. ¼, SE. ¼ Sec. 24, T. 36 N., R. 3 W., was shut down at 2,290 feet in the Madison limestone, with outcome questionable.

NEW MEXICO

The Continental Oil Company's Navajo No. 1, in the NE. ¼, SW. ¼ Sec. 13, T. 29 N., R. 19 W., was drilled on a seismic "high" 2 miles south of the nearest deep tests in the Rattlesnake field, and found gas at 6,948–6,950 feet, total depth, in the Ouray dolomite (?) (Devonian). The gas contained 83.4 per cent nitrogen, 9.8 per cent methane, 5.9 per cent ethane, and 0.9 per cent carbon dioxide and oxygen. The well was shut in after conferences with Geological Survey and Bureau of Mines representatives, and later the lease was assigned to the United States. The company has taken other leases on the Tocito and Bi-Clah-Bi-To structures.

The Barker gas field was reopened by the drilling of the Southern Union Production Company's Ute No. 1, in the NW. ¼, NW. ¼ Sec. 21, T. 32 N., R. 14 W., in January, 1942. The Dakota gas sand was at 2,398–2,495 feet, total depth. Two other gas wells were completed. The discovery well on this structure was drilled by the Gypsy Oil Company in 1925, but was abandoned due to lack of market.

UTAH

A well drilled by the Mack Drilling Company for the Defense Plant Corporation in coöperation with the Utah Magnesium Corporation and others in the Crescent-Salt Valley area attracted publicity in 1943, when information concerning it was released. The well is in the SW. ¼, SE. ¼ Sec. 4, T. 22 S., R. 19 E., and drilled Mancos shale (Upper Cretaceous), Dakota sandstone, and Morrison formation to 2,091 feet, then entered the Paradox formation (Pennsylvanian). Several showings of oil were reported, including 43° A.P.I. gravity oil at 4,190–4,207 feet. The well was drilled more for the exploration of magnesium and other salts, and is not a new discovery. Previous oil showings were reported in the offsetting Crescent Eagle and other wells drilled to about 4,000 feet.

WYOMING

In addition to fields already mentioned, an exceptional well was the Sinclair-Wyoming Oil Company's No. 10, in the SE. ¼, NW. ¼ Sec. 11, T. 26 N., R. 90 W., in the Lost Soldier field, which at a location about 1,000 feet east of the nearest producer, was 1,202 feet lower structurally and drilled 1,213 feet of Tensleep sandstone on a steep dip, compared with 366 feet in the well on the west. No particular extension is predicated, due to the dip and lack of information at other points on the structure.

IMPORTANT DRY HOLES

COLORADO

Fourteen wildcats were in operation, as compared with 22 in 1941. At the end of the year, 7 of these were drilling or suspended and 7 were abandoned. No discoveries had resulted. The Superior Oil Company's Helman No. 1, in the NW. ¼, SW. ¼ Sec. 5, T. 3 S., R. 101 W., at Douglas Creek, was shut down for

the winter, cased to bottom at 7,313 feet in the Weber quartzite (Pennsylvanian). O. E. Torrey's Whitson No. 1 at Kit Carson, in the NW. ¼, SE. ¼ Sec. 12, T. 13 S., R. 49 W., drilled mostly in 1941, was abandoned at 4,819 feet in the Marmaton formation (Pennsylvanian). The Stanolind Oil and Gas Company's Snell No. 1, in the SE. ¼, SW. ¼ Sec. 7, T. 20 S., R. 41 W., at South Towner, was abandoned at 5,994 feet in the Arbuckle limestone (Cambrian and Ordovician). The same company's House No. 1 at Holly, in the SW. ¼, NE. ¼ Sec. 32, T. 24 S., R. 41 W., was abandoned in the Arbuckle at 6,200 feet. The Continental Oil Company's Young No. 1 at Steele Hollow, in the SE. ¼, NE. ¼ Sec. 11, T. 19 S., R. 65 W., was abandoned in granite at 6,112 feet. The Kerlyn Oil Company's Borra No. 1 at El Dorado, in the NE. ¼, SW. ¼ Sec. 5, T. 1 S., R. 69 W., was 9,264 feet deep in the Lakota sandstone at the end of the year, and was deepened to 9,309 feet in January, 1943, then plugged back to 8,340 feet for testing a gas showing. The Ramsey Petroleum Corporation's Graham No. 1 at Buckingham-New Raymer, in the SW. ¼, SW. ¼ Sec. 14, T. 7 N., R. 59 W., was ready to abandon at 7,005 feet in the Lakota sandstone.

MONTANA

Nineteen wildcats were in operation as compared with 38 in 1941. Two are listed as small gas wells, 12 as suspended (including 2 possible oil wells), and 5 as abandoned. The Watson Oil Company's No. 2 at Rattlesnake Butte, in the SW. ¼, SE. ¼ Sec. 22, T. 13 N., R. 28 E., was abandoned at 2,797 feet in the Second Cat Creek sand of the Kootenai formation. The Texas Company's Kingsbury No. 1, in the SE. ¼, SE. ¼ Sec. 8, T. 29 N., R. 7 W., at Dupuyer, was abandoned at 4,208 feet in the Madison limestone after being unsuccessful in finding shoreline or reservoir conditions similar to those in the Cut Bank field. A. B. Cobb's Tribal No. 1, in the NW. ¼, NW. ¼ Sec. 4, T. 29 N., R. 8 W., on the Blacktail structure, was suspended for the winter at 2,880 feet in the Colorado shale (?). The Carter Oil Company's deep test at Cedar Creek, N. P. No. 1, in the SW. ¼, SE. ¼ Sec. 19, T. 4 N., R. 62 E., drilled to 9,680 feet in the pre-Cambrian in 1941, was abandoned in January, 1942, after testing all showings in the Mississippian and older formations. The two previous deep wells of the Montana-Dakota Utilities Company were indefinitely abandoned.

NORTH DAKOTA

The Carter Oil Company's Semling No. 1, in the SE. ¼, SE. ¼ Sec. 18, T. 141 N., R. 81 W., on the Wachter structure, was abandoned at 8,850 feet in the pre-Cambrian after drilling all formations present between the Tongue River member of the Fort Union (Eocene) and the Winnipeg (Ordovician).

SOUTH DAKOTA

Among a few scattered operations, the Continental Oil Company's State No. 1, on the Chilson structure, in the SE. ¼, NW. ¼ Sec. 36, T. 8 S., R. 3 E., drilled all formations present between the Dakota sandstone and the Pahasapa

limestone (Lower Mississippian), and was abandoned at 2,338 feet. An interesting stratigraphic test was the Provo water well of the U. S. War Department in the SE. ¼, SE. ¼ Sec. 3, T. 10 S., R. 2 E., which penetrated a section from the Carlile shale (Upper Cretaceous) to the pre-Cambrian and was carefully sampled and logged.

WYOMING

Forty-two wildcats were in operation in 1942, the same number as in 1941. Six of these were completed as oil and gas wells, 25 were drilling or suspended at the end of the year, including four possible oil or gas wells, and 11 were abandoned.

The Continental Oil Company's Johnston No. 1 at O'Brien Springs, in the SE. ¼, SW. ¼ Sec. 1, T. 24 N., R. 88 W., drilled mostly in 1941, was abandoned at 5,021 feet in the Tensleep sandstone. The General Petroleum Corporation's Renfrow No. 34, in the SE. ¼, NW. ¼ Sec. 15, T. 24 N., R. 66 W., at Wheatland or Antelope Gap, was abandoned at 5,342 feet in granite after drilling all formations present between the Ogallala (Miocene and Pliocene) and the Guernsey (Mississippian). The same company's Kopp No. 7, at South Cole Creek, in the SW. ¼, SW. ¼ Sec. 17, T. 34 N., R. 76 W., was abandoned at 7,214 feet in the Frontier formation after failing to find production in it or in the Shannon sandstone member of the Steele shale (Upper Cretaceous), which is productive in the near-by Cole Creek field. The Cow Gulch Oil Company's Nelson No. 1 at Southwest Lance Creek in the SE. ¼, SW. ¼ Sec. 19, T. 35 N., R. 65 W., was abandoned at 6,555 feet in the Minnelusa sandstone (Pennsylvanian) after tests proved unsatisfactory. The Sinclair-Wyoming Oil Company's No. 25 at East Ferris in the SE. ¼, NW. ¼ Sec. 25, T. 26 N., R. 87 W., was abandoned in steep dips of the Tensleep sandstone at 5,057 feet. The Continental Oil Company's Coltharp No. 1, at Moorcroft, in the SE. ¼, NW. ¼ Sec. 18, T. 51 N., R. 66 W., was 3,330 feet deep at the end of the year and was later abandoned at 3,511 feet in the Deadwood formation. Several showings in the Minnelusa sandstone below 1,475 feet were tested, the first of which, a gas showing in the Converse sand, was 99.34 per cent nitrogen.

Incomplete wildcats include the Superior Oil Company's Brimmer No. 1, in the NW. ¼, NE. ¼ Sec. 32, T. 27 N., R. 89 W., at Bunker Hill, suspended at 8,918 feet in the Tensleep sandstone; and the British American Oil Producing Company's Tribal No. 1, at Steamboat Butte or Northwest Pilot Butte, in the NW. ¼, NW. ¼ Sec. 5, T. 3 N., R. 1 W.[3]

PIPE LINES

Pipe-line activity was minimized and consisted of a few gas lines and short lines or replacements. A 6-mile line was laid from the Maverick Springs field in

[3] At the time of completion of this manuscript in 1943, this well had sampled oil showings in the Dakota and Lakota sands, and appeared to be a good producer in the Sundance formation, which would make it practically the first oil well in that formation in the Wind River and Big Horn basins.

Wyoming to a position favorable for truck loading late in 1941, and commenced runs in January, 1942. A 4-mile line from the Circle Ridge field was connected with this line in June, 1942. An old 2-inch line from the Notches field in Wyoming was replaced by a 4-inch line. A 30-mile gas line from the Cut Bank gas area in Montana to the Kevin-Sunburst gas area furnishes more gas for the Shelby-Great Falls system. An additional 5-mile loop near the Muskrat gas field in Wyoming increases the capacity of the Big Sand Draw-Casper line. The Sherard gas field in Wyoming was connected with the Lost Soldier district line to Sinclair. The new Barker, New Mexico, gas wells, were connected with the Ute Dome-Kutz Canyon line.

OIL PRODUCTION IN BARRELS*

State	*1940*	*1941*	*1942*	*Accumulated*
Colorado	1,702,090	2,106,610	2,286,637	44,431,153
Montana	6,661,358	7,515,635	8,063,817	97,908,761
NW. New Mexico	411,156	414,013	434,496	8,187,042
Utah	3,275	3,635	1,685	197,310
Wyoming	25,906,481	30,332,577	32,855,491	564,901,377
Totals	34,684,360	40,372,470	43,642,126	715,625,643

* Compiled by the Geological Survey from various sources. Production from gas wells in the Clay Basin field, Utah, and North Baxter Basin, Wyoming, not included.

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OIL DEVELOPMENT ACTIVITIES IN CALIFORNIA, 1942[1]

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ABSTRACT

The Office of Petroleum Coördinator, now changed to the Petroleum Administrator for War, made a survey during the year of the reserves of all oil in the state under 24° Bé. gravity. The California Oil Administrator then made a survey of reserves of all oil over 24° Bé. gravity.

Results of these two surveys indicated that the total California reserves were 3,300,000,000 barrels but that the available oil was insufficient to meet present increased market demands.

Certain steps were taken by regulatory bodies to increase reserves of oil and available oil especially of the grade designated as "heavy" oil. The most important of these steps was the action of the City of Los Angeles in permitting the drilling of an exploratory well within a residential district.

The activity of the operators was almost entirely confined to the exploration of shallow undeveloped reserves of heavy oil. This activity was the direct cause of several important extensions to known fields.

There were five new oil-producing areas and three new gas-producing areas discovered during the year. Extensions were made, either as the results of the development of heavy reserves or from routine development of 1941 discoveries, in 13 fields. Deep sands were found under three producing fields.

In the light of present knowledge, the new discoveries appear to be unimportant in comparison to the yearly demand of the state which under the war emergency has risen to 288,000,000 barrels a year. It is probable that reserves established by the new discoveries will not exceed 10 per cent of this demand. However, extensions and deep-sand discoveries probably have added considerably to the reserves.

Lack of man-power, equipment, and a low crude market have materially decreased the activity of California operators during the year. The P.A.W. has attempted to encourage the development of new areas and old reserves by various methods but the operators can not obtain materials readily and the competition for labor can not be met at the present price of crude, especially at the price of the heavier grades of the crude now in demand.

GENERAL

The principal events in the California oil industry during 1942 had more to do with political and governmental regulations than with development. This was due to the fact that several outstanding regulations and ordinances were put into effect, and no important discoveries indicating substantial additions to reserves were made.

Chronologically, the following important events took place resulting from regulatory bodies.

1. The Office of Petroleum Coördinator, in answer to the plea of California operators, for relief from Order M-68, instigated an exhaustive survey of California conditions and the state's reserves of "heavy oil" which included all oil under 24° Bé. gravity. Results of this survey were published in the late summer.

2. To supplement this survey and to complete the statistics on California reserves, the office of the California Oil Administrator made a study and published results, in the early fall, of a light-oil survey listing reserves of oil over 24° Bé. gravity.

[1] Manuscript received, February 20, 1943. Presented before the Association by title at Fort Worth, April 7–9, 1943.

[2] Bankline Oil Company, 437 South Hill Street. The generosity of E. H. Vallat in furnishing the map accompanying this report, and in constructively reviewing the subject matter is greatly appreciated.

3. In recognition of a possible shortage of certain types of oil, the Los Angeles City Council passed a special ordinance permitting the drilling of an exploratory well for oil in the center of an important residential district.

4. The United States Department of the Interior decreased the sliding-scale royalty to a straight 12½ per cent royalty on Government lands where discovery is made, to encourage wildcatting.

5. The W.P.B. issued M-68-3 permitting closer spacing than provided in M-68 in certain California fields.

6. Gasoline rationing was put into effect on the Pacific Coast.

A study of data developed by the O.P.C., now the Petroleum Administrator for War, and the California Oil Administrator, brought out some rather startling facts, the most important of which was that although the total California developed reserve of crude oil was 3,300,000,000 barrels, a shortage of available oil is threatened.

The available oil was estimated as follows.

	1943	*1944*	*1945*	
Heavy	106,000,000	92,500,000	82,000,000	
Light	181,000,000	165,000,000	150,000,000	
	287,000,000	257,500,000	232,000,000	barrels

The California oil industry is at present, and will be for the duration of the war, called on to supply, in addition to its regular peace-time markets, a large portion of the markets formerly supplied by the Dutch East Indies, the demands of the Military, and vastly expanded defense industries. A measure of these demands is indicated by the increase in allowable production for California. The allowable for January, 1942, was 612,000 barrels per day, or at the rate of approximately 225,000,000 barrels per year. This was steadily increased throughout the year; the December production averaged 773,850 barrels per day, or at a yearly rate of 288,000,000 barrels.

It can be seen from the foregoing table that the developed supply is not adequate to meet the demand for the next few years. It is important to note that the situation is more acute than it at first appears, inasmuch as the major portion of the present demand is for the heavy grade of oil. The November, 1942, demand for heavy oils in the California market was as follows.

	Barrels per Day
Light fuel oil	75,000
Residual fuel oil	380,000
Asphalt	32,000
Total	487,000

The demand of 487,000 barrels per day is at the rate of 178,000,000 barrels annually. By again referring to the table of available oil it is seen that there is a scarcity of certain types of crude. It is obvious that refiners can not economically refine high-gravity crude for its fuel content alone, but such an emergency procedure may yet be forced on the industry.

These pertinent facts, along with other important data developed, were contributory to the relaxing of the M-68 order as applied to California, decreasing of royalty rates on Government lands, and passing of the special drilling ordinance by the City of Los Angeles.

Inauguration of gasoline rationing on December 2 further aggravates the already unbalanced market demand between residuum and gasoline. During 1942, the fuel-oil demand increased 28 per cent from 380,000 barrels per day average, for January, to 487,000 barrels per day demand, for November, while the gasoline demand increased only 12.6 per cent from 207,000 barrels per day for January, to 237,000 barrels per day for November.

While the governmental bodies have attempted to encourage additions to the available oil supply, California operators have expended every effort, in spite of handicaps and restrictions, to develop heavy oil, even though it is more remunerative to them to develop and produce lighter grades of oil due to the price structure. It can be truthfully said that the oil industry in California has unselfishly gone out, wholeheartedly, for National Defense. Many operators have drilled and are carrying out development campaigns for heavy-oil reserves, which, due to the high cost of material, labor, and upkeep, they can not now produce at a profit.

The following tabulation illustrates the trend of California development for the year.

Completions during 1942—Oil	557
Completions during 1942—Gas	25
Total completions	582
Abandoned drillers	247
Total wells drilled	829
Locations staked	980
Total production, 1942	248,326,216 barrels
Total new production developed	199,313 barrels per day
Total recompleted production added	23,879
Crude oil stocks decreased during the year	2,135,000 barrels

In order of the number of completions, the following fields were most active.

Field	*Completion*	*Added Production (Barrels per Day)*	*Gravity Range (Degrees)*
South Belridge	86	4,597	14.0–16.0
Midway Sunset	62	4,594	12.0–23.0
Coalinga	43	27,718	17.0–20.0
Wilmington	38	9,305	16.0–21.0
Santa Maria Valley	29	16,983	14.0–17.0
Mt. Poso	26	2,640	15.0–17.0
Kern River	25	1,964	15.0–17.0
Huntington Beach	21	5,665	15.0–29.0
Ventura Ave.	16	18,412	30.0–32.5
Coles Levee	14	19,042	32.0–34.0
Kettleman Hills	14	6,802	35.0–42.0
Torrance	11	1,194	16.0–19.0
Antelope Hills	11	3,064	16.0–17.5
Riverdale	11	3,473	35.0–40.0
All others	150	73,860	
Total	582	199,313	

The foregoing data clearly indicate the effort the industry has made to develop heavy crude. The newly discovered Riverdale field is the only high-gravity field which has had any appreciable development this year, aside from routine or necessary drilling at Coles Levee, Kettleman Hills, and Ventura Avenue.

The value of California crude oil of 12°–18° gravity, although varying from field to field, ranges from 62 cents to 85 cents per barrel. Generally speaking, although this also varies, the cost of development ranges from approximately 25 cents to 40 cents per barrel. Production cost ranges from 20 to 35 cents per barrel. From these figures it can be seen that in many fields where production per well is low the margin of profit to the operator is very small.

The operators have been faced with many difficulties. Their inability to compete with the aeroplane factories, ship yards and other defense plants, as well as the loss of many men to the armed forces, has developed an acute labor shortage. Material has been very scarce. Very little tubular goods have been received from the mills. Supply houses frequently have had no casing available and could not promise any. There are cases of wells being completed which could not be placed on production for lack of pumping units and power plants. Wells have been shut down due to lack of replacements. Only the larger operators have been financially able to continue to develop heavy oil at the present price of crude.

Wildcatting has been materially decreased for one or more of the foregoing reasons. Development was chiefly confined to the relatively safer drilling of known reserves, and the extensions of known fields due to narrowing profits, squeezed between a frozen price and rising costs of operation and development.

Five new oil- and three gas-producing areas were discovered, none of which will probably add very greatly to the reserves of the state. There were 13 extensions made to known productive areas, although four of these were of the nature of routine development of 1941 discoveries. Deeper sands were discovered in three producing fields. Appreciable amounts of new reserves have not been discovered since 1938 according to estimates made by the O.P.C. and the California Oil Administrator. A compilation of these discoveries follows.

	*Reserves Discovered** (*Barrels*)
1938	559,600,000
1939	19,525,000
1940	20,777,000
1941	17,075,000
1942 (to Nov. 1)	2,600,000 (Preliminary estimate)

* New discoveries, exclusive of reserves developed by extensions and deep sands.

The operators have been relatively active in geophysical surveys, especially doing a considerably increased amount of gravity-meter work. Due to the recent discovery of Miocene and Eocene production in the Fresno area, exploratory activity has been directed to the northern San Joaquin and Sacramento valleys. These two areas have been the center throughout the year of a large amount of geological and geophysical exploration and a considerable number of wildcat wells have been drilled or staked in these areas.

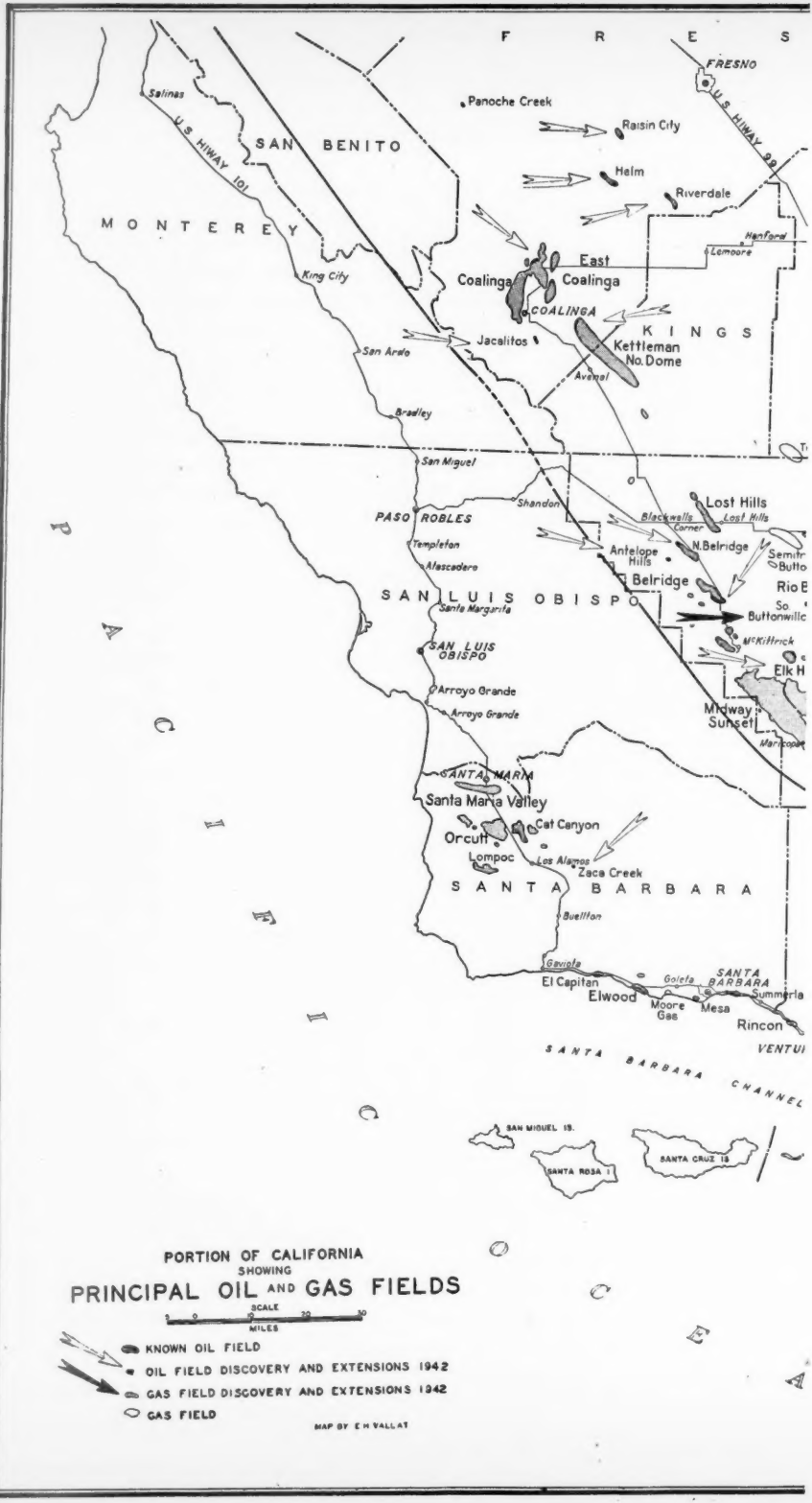
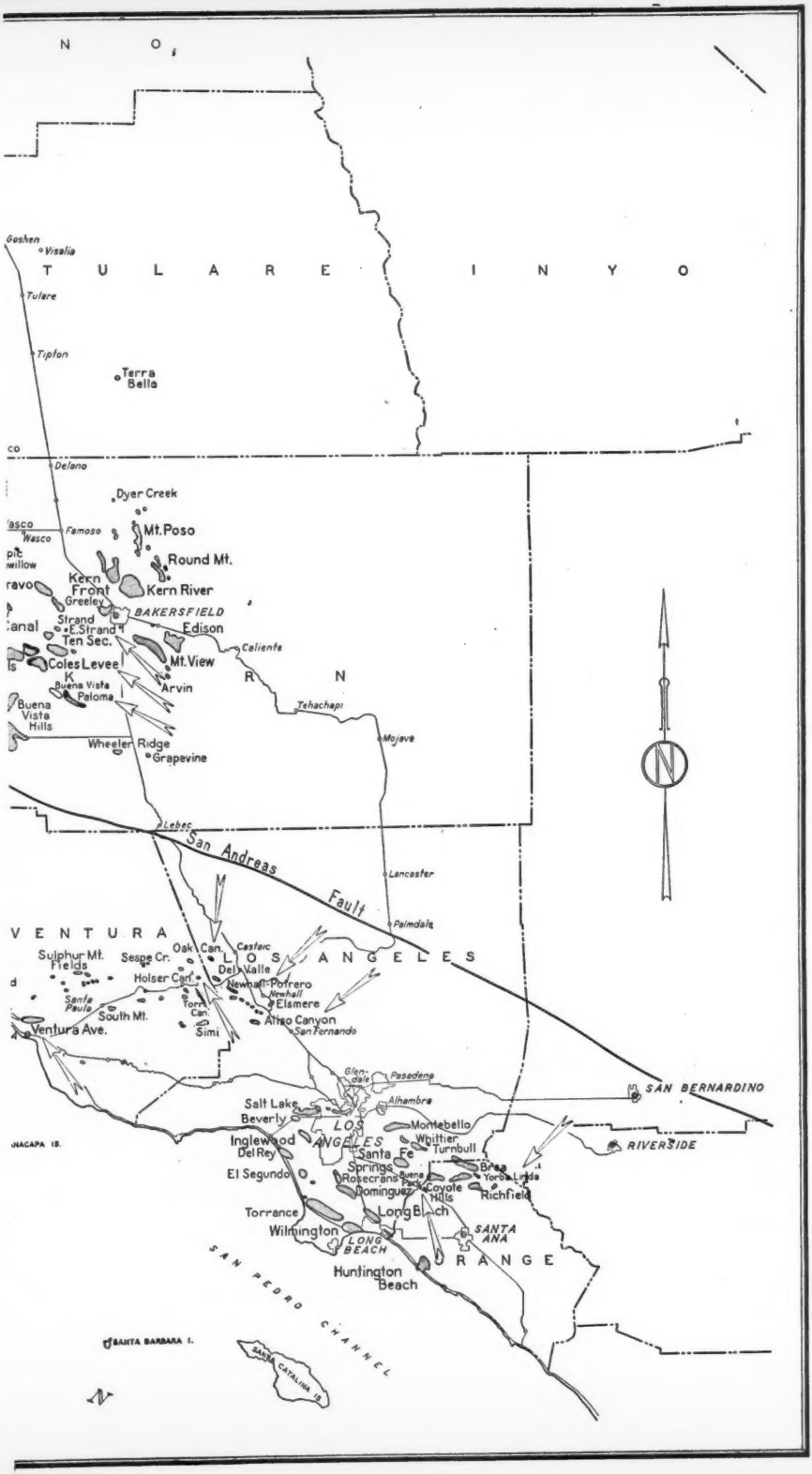

F R E S
FRESNO
U.S. HIWAY 99
Panoche Creek
Raisin City
Helm
Riverdale
Hanford
Lemoore
SAN BENITO
U.S. HIWAY 101
Salinas
MONTEREY
King City
East Coalinga
Coalinga
COALINGA
KINGS
Kettleman No. Dome
Jacalitos
San Ardo
Avenal
Bradley
San Miguel
Shandon
PASO ROBLES
Templeton
Atascadero
Lost Hills
Blackwells Corner
Lost Hills
Antelope Hills
N. Belridge
Belridge
SAN LUIS OBISPO
Santa Margarita
SAN LUIS OBISPO
McKittrick
Elk H
Arroyo Grande
Arroyo Grande
Midway Sunset
SANTA MARIA
Santa Maria Valley
Cat Canyon
Orcutt
Lompoc
Los Alamos
Zaca Creek
SANTA BARBARA
Buellton
Gaviota
El Capitan
Elwood
Goleta
SANTA BARBARA
Moore Gas
Mesa
Summerla
Rincon
VENTU
SANTA BARBARA CHANNEL
SAN MIGUEL IS.
SANTA ROSA I.
SANTA CRUZ IS.
PACIFIC OCEAN
PORTION OF CALIFORNIA
SHOWING
PRINCIPAL OIL AND GAS FIELDS
SCALE
MILES
KNOWN OIL FIELD
OIL FIELD DISCOVERY AND EXTENSIONS 1942
GAS FIELD DISCOVERY AND EXTENSIONS 1942
GAS FIELD
MAP BY E H VALLAT

FIG. 1


N O
Goshen
Visalia
T U L A R E
I N Y O
Tulare
Tipton
Terra Bella
co
Delano
Dyer Creek
Famoso
Mt. Poso
Wasco
Round Mt.
Kern Front
Kern River
Greeley
BAKERSFIELD
Strand
E. Strand
Ten Sec.
Edison
Coles Levee
Mt. View
Caliente
Buena Vista
Paloma
Arvin
R N
Buena Vista Hills
Tehachapi
Wheeler Ridge
Grapevine
Mojave
Lebec
San Andreas Fault
Lancaster
Palmdale
V E N T U R A
L O S A N G E L E S
Sulphur Mt.
Fields
Sespe Cr.
Oak Can.
Castaic
Del Valle
Holser Can.
Newhall-Potrero
Newhall
Elsmere
Santa Paula
South Mt.
Torrey Can.
Simi
Ventura Ave.
Aliso Canyon
San Fernando
Glendale
Pasadena
SAN BERNARDINO
Alhambra
Salt Lake
Beverly
Montebello
Whittier
Turnbull
Inglewood
Del Rey
Santa Fe Springs
RIVERSIDE
Brea
Yorba Linda
El Segundo
Rosecrans
Dominguez
Coyote Hills
Richfield
Torrance
Long Beach
Wilmington
LONG BEACH
SANTA ANA
R A N G E
Huntington Beach
SAN PEDRO CHANNEL
SANTA BARBARA I.
SANTA CATALINA I.
N

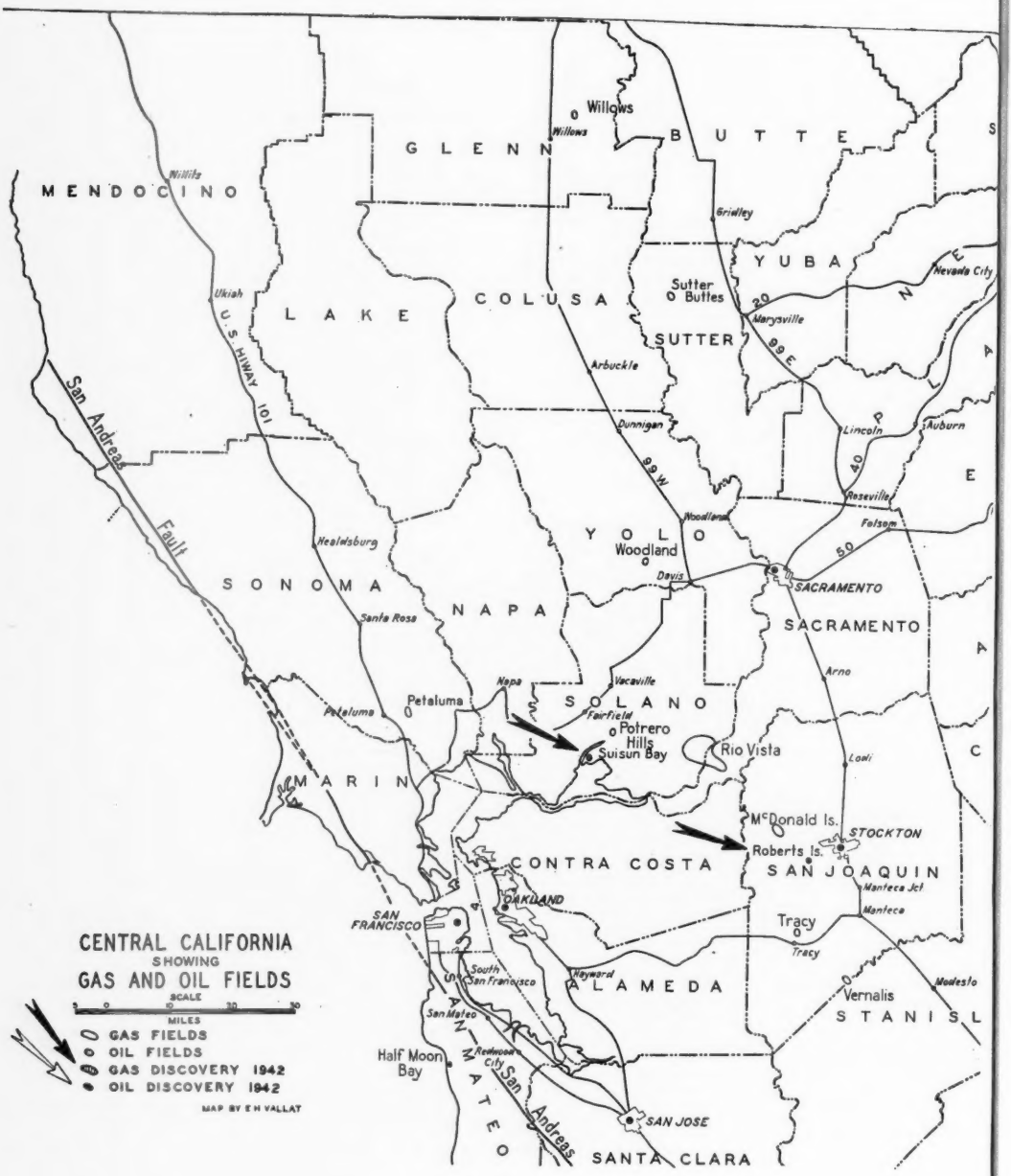

Willows
Willows
GLENN
BUTTE
MENDOCINO
Willits
Gridley
YUBA
Nevada City
Ukiah
U.S. HIWAY 101
LAKE
COLUSA
Sutter Buttes
20
Marysville
SUTTER
99E
Arbuckle
Dunnigan
99W
Lincoln
Auburn
40
PLACER
Roseville
Folsom
Woodland
YOLO
Woodland
Davis
50
SACRAMENTO
Healdsburg
SONOMA
NAPA
Santa Rosa
SACRAMENTO
Arno
Napa
Vacaville
Petaluma
Petaluma
SOLANO
Fairfield
Potrero Hills
Suisun Bay
Rio Vista
Lodi
MARIN
McDonald Is.
STOCKTON
Roberts Is.
CONTRA COSTA
SAN JOAQUIN
Manteca Jct
OAKLAND
Manteca
SAN FRANCISCO
Tracy
Tracy
South San Francisco
Hayward
ALAMEDA
Vernalis
Modesto
San Mateo
STANISL
Half Moon Bay
Redwood City
SAN MATEO
San Andreas
Fault
SAN JOSE
SANTA CLARA
CENTRAL CALIFORNIA
SHOWING
GAS AND OIL FIELDS
SCALE
0 10 20 30
MILES
GAS FIELDS
OIL FIELDS
GAS DISCOVERY 1942
OIL DISCOVERY 1942
MAP BY E H VALLAT

FIG. 2

OIL DISCOVERIES

Antelope Hills.—The Shell Oil Company's Williams 45–6 established the presence of a shallow heavy-oil field in the Antelope Plains area of the Belridge district of Kern County. The well was completed in a middle Miocene sand from 2,280 to 2,340 feet, with an initial production of 937 barrels per day of 16.4° gravity oil. At the close of the year there had been completed 11 oil wells, one gas well, and one dry hole. The discovery of this field was due to exhaustive geological study, extensive core drilling, and some seismograph work carried on over a great many years.

East Strand.—On November 29, the Tide Water Associated Oil Company completed KCL 56–8, flowing 1,000 barrels per day of 31° oil from the Stevens sand member of upper Miocene age. The well is only a mile east of the Strand field in Kern County but is separated from that field by a dry hole. Production was found between the depths of 8,100 and 8,207 feet. At the end of the year, the company was deepening this well to explore the lower members of the Stevens sand. The well was drilled on seismograph evidence.

Buena Park.—Near Buena Park, in the Los Angeles basin, 15 miles southeast of Los Angeles, The Texas Company completed Spencer No. 1 in lower Pliocene beds from a perforated interval of 8,900 to 8,932 feet. The well was drilled to 9,660 feet into the top of the Miocene and plugged back, testing in stages, showings which had been encountered. The initial production was 175 barrels per day of 21.2° gravity oil.

The completion of this well on the basis of previous discoveries in the Los Angeles basin presaged the development of important reserves, but subsequent drilling has so far been discouraging. Following the completion of this well, The Texas Company drilled three more wells and staked a fifth location. Two of these wells were dry and were abandoned. The other was completed, producing approximately 400 barrels. Accumulation is probably due to buttressing of lower Pliocene beds against eroded Miocene on a sharply folded northwest-plunging anticlinal nose. Discovery is due to extensive subsurface study of the many wells drilled on this nose for the buttressing of sands which it was known must exist.

Holser Canyon.—In the Piru Creek area of Ventura County, the Continental Oil Company completed Holser No. 1 in upper Miocene sand between the depths of 4,103 and 4,663 feet. The production is approximately 100 barrels per day of 23° gravity oil. The structure at the surface is a very sharp anticline bounded on the north by a large, south-dipping thrust fault. The well is believed to have encountered several faults at depth so that the exact nature of the structure is not as yet known. Location for a second well has been staked. Field mapping was the means of discovery.

Zaca Creek.—The Tide Water Associated Oil Company drilled Davis No. 1 to the total depth of 6,643 feet, where the well was bottomed in Eocene?. The well was plugged back and completed in the interval from 4,615 to 5,956 feet, producing 125 barrels of 10° gravity oil from fractured chert of upper Miocene age. Discovery was accomplished by surface mapping.

GAS DISCOVERIES

Roberts Island area.—Standard Oil Company completed Woods No. 1 in the Stockton area of the Sacramento Valley, producing 5,600,000 cubic feet of gas, on $\frac{3}{8}$-inch bean, at 5,230–5,250 feet. Shut-in pressure was 2,022 pounds. This well is $4\frac{1}{2}$ miles southeast of the previously discovered McDonald Island field. Although Roberts Island may be an extension of this field it is mapped as a separate structure by seismograph. Production is from the McDonald Island sand of Paleocene age. No further development has taken place.

South Buttonwillow.—During the early part of 1942, The Texas Company established the presence of gas in upper Pliocene beds in three wells drilled in T. 29 S., R. 24 E., M. D. B. & M. Production comes from the south Buttonwillow dome and is from the same zone that has been producing in the North Buttonwillow dome.

Suisun Bay.—Presence of a possible gas field was indicated when Standard Oil Company, Suisun Community 2-1 in Section 25, T. 3 N., R. 1 W., M. D. B. & M. blew gas between the $9\frac{5}{8}$- and $5\frac{1}{2}$-inch casing. The well is prospecting a seismograph "high" in the South Sacramento Valley. At the close of 1942 the well was testing for production.

EXTENSIONS

Helm.—The Helm oil field, discovered by the Amerada Petroleum Corporation in 1941, has been extended $2\frac{1}{2}$ miles southeast by the completion of Truman No. 1. Initial production was 125 barrels of 61° gravity oil, with 2,400 pounds of flow pressure and 2,236 M.C.F. of gas. There has been completed at the end of 1942 seven producing wells and one dry hole in this field.

Coalinga.—In the Coalinga nose area the limits of the old Temblor production have been extended by the Tide Water Associated Oil Company and by the Standard Oil Company in the vicinity of Sec. 35, T. 19 S., R. 15 E., and by the Shell Oil Company in the vicinity of Secs. 29 and 32, T. 19 S., R. 15 E. Completions range from 100 to 400 barrels of 26°–31° gravity oil.

Jacalitos.—The Jacalitos field, discovered in 1941, has been extended by recent drilling to include approximately 300 acres of upper Temblor production. There have been completed five producing wells and two dry holes.

Kettleman Hills North Dome.—A moderate amount of orderly development of the previously discovered Eocene sand has taken place throughout the year. The Kettleman Hills North Dome Association completed 321-30 J in this sand from 10,840 to 10,960 feet, thus extending the limits of the field $\frac{1}{2}$ mile northwest. Initial production was 126 barrels of 41.8° gravity, 2,400 pounds of flow pressure with 5,000 M.C.F. of gas.

North Belridge.—The presence of a middle Miocene sand on the northwest plunge of this field has been established. This sand exists only in the northwest part of the field. The sand is designated by electric-log symbol R and is known as the "R zone." The Belridge Oil Company completed 31, R-28 in Sec. 28,

T. 27 S., R. 20 E., from 8,505 to 8,790 feet, thus extending the proved limits of this zone northwest. This discovery established the presence of a producing zone, 1,000 feet beyond the producing limits of the Belridge 64 zone. Later in the year, the Tide Water Associated Oil Company completed 25-21, Sec. 21, T. 27 S., R. 20 E., in this zone, thus further extending the productive limits northwest.

South Belridge.—During 1942, the Belridge Oil, the General Petroleum, the Ohio Oil, E. A. Parkford, and the Union Oil have been active, developing the south flank and southeast plunge of the old South Belridge field. Some of the wells were within the limits of the old field but a completion by the Union has extended the limits of the field ½ mile south, and development by E. A. Parkford has extended the production one mile southeast. Production ranges from 10 to 100 barrels of oil; the gravity ranges from 12° to 15°. The oil is being produced from basal Tulare beds of upper Pliocene age; depths range from 400 to 1,500 feet.

Coles Levee.—Minor extensions of this field were made by the Richfield Oil. An extension of ¼ mile was made northwest and an extension of ½ mile was made southeast. The Richfield also determined the north limit of the field when its 63-29 in Sec. 29, T. 30 S., R. 25 E., was wet in the producing zone.

Paloma.—Two notable extensions to this field were made during the year. The Western Gulf Oil Company drilled Simmons 12-7 in Sec. 7, T. 32 S., R. 27 E., to the total depth of 11,811 feet, and, after finding the main producing zone low and wet, plugged back and completed the well in a sand in uppermost Miocene which had not heretofore been encountered. This established the presence of a productive zone one mile east of any production previously known. The well produces from a depth of 10,930 to 10,990 feet. Initial production was 42 barrels, 50° gravity, 1,120 pounds flow pressure, with 45 M.C.F. of gas. More recently, the General Petroleum Corporation completed Gallagher 61-33, Sec. 33, T. 31 S., R. 26 E., in the main productive zone of the field, at the depth of 11,000 to 11,043 feet. Initial production was 648 barrels of 34.3° gravity, 800 pounds flow pressure. 648 M.C.F. of gas. This well not only extended the limits of the field one mile north but establishes the presence of a black-oil band in this field. It had previously been supposed that the 64–65° gravity oil which had heretofore been produced was the only fluid that was obtainable from this field and that the field had been definitely established as a condensate field.

Oak Canyon.—The field discovered last year by the Western Gulf Oil Company has been slowly developed in the deep Lechler zone. At present, about 300 acres have been proved. There are seven producing wells.

Newhall Potrero.—The Texas Company successfully completed Newhall No. 1 to extend this field a few locations northwest. Although this well was not a large producer, it is important inasmuch as the presence of oil in the well, at a structural position 1,200 feet lower than the highest well in the field, indicates considerable reserves in the known zone. Cornelius G. Willis completed Ferguson No. 1 in the top zone of the field at 6,200 to 6,835 feet after having drilled to 7,519 feet where the main producing zone was found to be gray. Initial produc-

tion was 235 barrels, 34.2° gravity and 150 pounds flow pressure with 200 M.C.F. of gas. This discovery extends the field 1½ miles southeast and proves an area that had been previously believed to be outside the structural closure of the field. Further development might prove this to be a separate field and thus make the well a new discovery.

Yorba Linda.—After having discovered production in the east part of the Yorba Linda field in a core hole drilled in 1938, the Shell Oil Company spent the latter part of 1942 exploiting this area. This development extends the proved limits of the field almost a mile northeast. Production is found at 2,100 feet and initial production averages about 100 barrels per day of 19.3° gravity oil.

Aliso Canyon.—The Tide Water Associated and the Standard Oil companies drilled a joint test, Sesnon No. 1, about ½ mile west of the proved limits of this field. The well was completed in the Porter 12 zone, lower Miocene, at the depth of 8,835 to 9,086 feet, flowing 2,400 barrels of 23.9° gravity oil.

Ventura Avenue.—During 1942 several wells have been drilled on the north flank of this field. Activity has been unhurried even though initial production has been 2,000 barrels or more. The important development so far has been by the Shell Oil Company on its large Taylor lease, which covers the west ⅓ of the field. There the proved limits have been extended ½ mile north and northwest.

Deep zones.—A deep zone was discovered in the North Belridge field in Kern County by the Belridge Oil Company when it completed well 47-27 in Sec. 27, T. 27 S., R. 20 E., at 8,505 to 8,591 feet after having drilled to 9,637 feet. Production is coming from a sand member in the Kreyenhagen shale of Oligocene age. Initial production was 1,224 barrels, 30° gravity, 789 M.C.F. of gas.

Del Valle.—At the end of the year, R. E. Havenstrite was drilling Barnes No. 2 as a deep test. A formation test from 7,866 to 7,975 feet established the presence of considerable quantity of 42° gravity oil and a second sand was successfully tested from 8,120 to 8,178 feet. This sand produced 41.4° gravity oil. Both sands are upper Miocene in age.

Elk Hills.—Development during the latter part of 1941 and 1942, by the Standard Oil Company, probably was more important in determining considerable amounts of reserve oil than any other activity in California. Although no detail information was made public, due to development being within the Naval Petroleum Reserve, and the work being in coöperation with the Navy, it is known that two productive zones were found below the previously known productive zones. The first zone is near the Stevens sand of upper Miocene age and the second is probably either Vedder or close to Vedder in lower Miocene beds. It is known that wells completed in these sands have potentials of more than 1,000 barrels. Inasmuch as most of the wells, five in all, were near the top of the structure, their completions may establish the presence of many millions of barrels of oil.

Riverdale.—The Amerada Petroleum's Young 4-15, Sec. 15, T. 17 S., R. 19 E., was drilled to 8,500 feet at which depth it was stopped in Cretaceous. A forma-

tion test of Domengine sand of middle Eocene age, between the interval 7,840–7,940 feet, blew oil and gas. The well was then plugged and completed in the main producing zone of the field without further test. This successful formation test indicates that production will be obtained from at least part of the field in Eocene. The limits of this production probably will not be great because three previous wells, only slightly less favorably located structurally, have found the Domengine barren.

SUMMARY

The recognition of the need for further oil reserves by the Office of the Petroleum Administrator for War may help, in the future, to obtain an increase in price for heavier grades of crude oil which can not be developed at the present low price. Efforts may be made to relieve the man-power situation. Steel and other necessary materials may be made more readily available.

The City of Los Angeles, recognizing the dire national need for oil, granted special permission to drill within a residential area. This may be the start in the development of very important reserves. There are two extensive shallow oil-producing areas within the city and several favorable structures are known. It is believed that a large amount of relatively shallow reserves should be obtained.

Although oil was discovered in five new areas during the year, it is not believed, from present knowledge, that these discoveries will add appreciably to the known reserves. A preliminary estimate of 2,600,000 barrels of new reserves was set up for the new 1942 discoveries. This figure will undoubtedly be proved low but it is believed that the discoveries will not exceed 25,000,000 barrels of reserve.

The extension of old shallow areas and the discovery of deeper sands probably will contribute a moderately large amount of new reserves. The amount of these reserves can not be determined at this time as sufficient development has not taken place to warrant a preliminary estimate.

Continued studies of stratigraphic problems contributed two of the five discoveries and several of the extensions. Geological efforts along this line will undoubtedly develop more production when the variations in sedimentation in the various basins are better understood. Geological efforts during the year were principally directed along this line as well as to the development of new areas in the north San Joaquin and Sacramento valleys.

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VOL. 27, NO. 6 (JUNE, 1943), P. 874

GEOLOGICAL NOTES

CALCULATING THE TRUE THICKNESS OF A FOLDED BED

G. D. HOBSON[1]
London, England

The following corrections should be made in the geological note, "Calculating the True Thickness of a Folded Bed," in the December, 1942, *Bulletin*, Volume 26, Number 12.

P. 1827. Footnote. For "Professor" read Department.

P. 1828. Line 15. Delete "$h \cdot \cos \alpha$," at the beginning.
Line 22. For "R_1/h" read R_1/t. For "10" read 20.
Line 23. For "R_1/h" read R_1/t.

P. 1829. Figure 2. For "$\frac{R_1}{t} = 10$" read $\frac{R_1}{t} = 20$.

P. 1830. Last line. For "$R_1\left(\frac{Y}{\tan \beta}+d\right)^2 \frac{\sin \alpha}{\tan \beta}$" read $R_1\left(\frac{Y}{\tan \beta}+d\right)\frac{2 \sin \alpha}{\tan \beta}$.

P. 1831. Line 16. For

"$$\sqrt{\left(\frac{\frac{m+n}{2}+d \cdot \tan \beta}{\tan \beta - \tan \alpha}\right)^2+\frac{m^2}{4}}$$" read $$\sqrt{\left(\frac{\frac{m+n}{2}+d \cdot \tan \beta}{\tan \beta - \tan \alpha}\right)^2+\frac{m^2}{4}}.$$

[1] Department of geology, Imperial College of Science and Technology, Prince Consort Road, South Kensington.

THE ORIGIN OF THE CAROLINA BAYS

CORRECTION

In John L. Ferguson's review of "The Origin of the Carolina Bays," by Douglas Johnson, in the May *Bulletin*, the following correction should be made.

Page 655, line 4 from bottom of page, "partially" should be *patiently*, so that the line reads "to support the patiently constructed theory."

BULLETIN OF THE AMERICAN ASSOCIATION OF PETROLEUM GEOLOGISTS
VOL. 27, NO. 6 (JUNE, 1943), PP. 875-881

THE ASSOCIATION ROUND TABLE

MEMBERSHIP APPLICATIONS APPROVED FOR PUBLICATION

The executive committee has approved for publication the names of the following candidates for membership in the Association. This does not constitute an election but places the names before the membership at large. If any member has information bearing on the qualifications of these nominees, he should send it promptly to the Executive Committee, Box 979, Tulsa, Oklahoma. (Names of sponsors are placed beneath the name of each nominee.)

FOR ACTIVE MEMBERSHIP

George Mitchell Furnival, Calgary, Alta., Canada
J. M. Kirby, John Galloway, W. C. Howells
Carl Edwin Siberts, Effingham, Ill.
T. E. Wall, J. Rex McGehee, C. E. Brehm
Walter Cyrus Warren, Washington, D. C.
Hugh D. Miser, Watson H. Monroe, William G. Pierce

FOR ASSOCIATE MEMBERSHIP

Marian Coffman Cody, Oklahoma City, Okla.
Dollie Radler Hall, V. E. Monnett, C. E. Decker
Norman Ware Ewbank, Jr., Austin, Tex.
Fred M. Bullard, L. C. Snider, W. A. Bramlette
Millicent Aloyse Renfro, Fort Worth, Tex.
Joseph H. Markley, Jr., Don G. Stookey, H. H. Bradfield
Beverly Lorraine Smith, Bakersfield, Calif.
Carey Croneis, Mason L. Hill, Harold W. Hoots
Richard Paul Swirczynski, Oklahoma City, Okla.
V. E. Monnett, C. G. Lalicker, Charles E. Decker
Dale Edward Turner, Bakersfield, Calif.
Ian Campbell, John P. Buwalda, Francis D. Bode

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Robert E. Rettger, *secretary*, Sun Oil Company, Dallas, Texas
Fritz L. Aurin, Southland Royalty Company, Fort Worth, Texas
Robert W. Clark, Western Gulf Oil Company, Los Angeles, California
Carey Croneis, University of Chicago, Chicago, Illinois

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WENDELL P. RAND	PHILIP B. KING	D. PERRY OLCOTT
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MEDAL AWARD COMMITTEE

A. RODGER DENISON[1]
Tulsa, Oklahoma

At the annual business committee meeting in Fort Worth, April 7, 1943, a proposal was made that the by-laws be amended to provide a new standing committee to be known as the medal award committee. The business committee approved this proposal and recommended to the annual business meeting that the amendment be adopted. The annual business meeting of the Association on April 9, 1943, approved the recommendation of the business committee and passed the amendment to the by-laws. The text of this amendment can be found in the complete text of the constitution and by-laws in the May, 1943, *Bulletin*.

The executive committee at its first meeting on April 9 considered and approved a plan for the establishment of a medal award to be known as "The Sidney Powers Memorial Medal of The American Association of Petroleum Geologists." The executive committee likewise considered and adopted the rules to govern the type and form of the medal to be given, and established rules for the purpose of choosing a candidate for the award. The rules so adopted follow.

[1] Chairman of committee.

RULES FOR THE SIDNEY POWERS MEMORIAL MEDAL AWARD OF THE AMERICAN ASSOCIATION OF PETROLEUM GEOLOGISTS

THE MEDAL AND PURPOSES OF THE AWARD

1. The name of the award shall be "The Sidney Powers Memorial Medal of The American Association of Petroleum Geologists."

2. The award shall be made in recognition of distinguished and outstanding contributions to or achievements in petroleum geology and shall be made at such times as the medal award committee may designate, but not more than once in any calendar year.

3. The medal shall be of gold and shall have a portrait of Sidney Powers on the obverse side and the name of the Association on the reverse side, together with suitable lettering, designs, scrolls, *et cetera*.

4. The medal shall be accompanied by an engrossed diploma of suitable design containing a citation of the contribution or achievement for which the award is made.

5. It shall be the duty of the medal award committee to cause to be made suitable designs for the medal and diploma, and cause them to be executed into dies and plates by a competent maker of such items.

THE FUND

1. For the purpose of establishing and perpetuating the award, a fund shall be established to be known as the "Sidney Powers Memorial Medal Fund."

2. The medal award committee shall have full power to solicit and accept, from members and others, subscriptions to the principal or interest of this fund. Under the conditions now existing, it will require a fund of $10,000 to return a sum adequate to carry on the plans outlined in these rules.

3. A part of the fund shall be set aside for the purpose of executing the design for the medal and diploma and in making the dies and plates for these items.

4. The remainder of the fund, after the original expenses, shall be carried on the books of the Association as a separate account, distinct from the other funds.

5. The income only from the fund shall be used for the purchase of the medal and diploma and no award shall be made unless sufficient funds are available.

6. After the original fund has been established, additions to the principal sum of the fund or donations to the income from the fund may be accepted at any time by the medal award committee.

ELIGIBILITY

1. There shall be no limitations in respect to membership in the Association, or nationality, or otherwise.

2. A candidate must be a living person able and willing to present himself in person to receive the medal and diploma at the time and place designated by the medal award committee.

SELECTION OF A CANDIDATE FOR THE AWARD

1. The chairman of the committee shall on or before October 1 of each year inquire of the secretary-treasurer of the Association whether sufficient funds are available to make an award during the current Association year.

2. If funds are available the committee shall proceed to the consideration of a candidate for the award as follows.

(a) The chairman shall advise the committee that funds are available for an award and shall invite each member to submit his ideas of whether there is a contribution to,

or an achievement in petroleum geology which is worthy of this award. If the majority of the committee advises that in their opinion there is such an achievement the chairman shall request from the committee the names of the eligible candidates for the award.

(b) Selection of a candidate for the award shall be by ballot, which shall be conducted by the chairman either by mail or at a meeting which he may call at a time and place of his designation. Such balloting must be completed by February 1, of the year in which the award is to be made. No candidate for the award may be chosen unless he receives the affirmative ballot of at least nine of the twelve members of the committee.

RECIPIENT OF AWARD

1. When a candidate for the award has been chosen, his name shall be submitted to the executive committee of the Association. If the executive committee approves the candidate, he shall be designated as the "Recipient of the Award." If the executive committee does not approve the candidate, no award shall be made.

2. When a recipient has been so chosen, he shall be notified by the chairman of the medal award committee of the time and place of the presentation, which should preferably be at the annual convention. The chairman shall make the necessary arrangements and shall preside at the formal presentation of the medal.

3. The chairman of the medal award committee shall cause to be printed in the *Bulletin* of the Association, a picture and biographical sketch of the recipient, together with a citation of the contribution or achievement for which the award was made.

4. The committee shall have power to decide any question not specifically covered by these rules by a majority vote.

AMENDMENT OF RULES

1. All rules and regulations governing this award may be amended at any time:

(1) By the executive committee; or

(2) By 9 (nine) members of the medal award committee with the approval of the executive committee.

In accordance with the newly adopted amendment to the by-laws the following committee has been named as the medal award committee. This committee consists of three *ex officio* members and nine members as the by-laws provide. They are as follows.

Ex-officio member and *chairman*

A. Rodger Denison	Tulsa, Oklahoma

Ex-officio members

J. Harlan Johnson, S.E.P.M.	Golden, Colorado
R. D. Wyckoff, S.E.G.	Pittsburgh, Pennsylvania

Members

1946	
Frank R. Clark, past-president	Tulsa, Oklahoma
J. A. MacDonell	Lima, Ohio
R. F. Baker	New York City
1945	
G. C. Gester, past-president	San Francisco, California
Darsie A. Green	Olney, Illinois
Wallace C. Thompson	Houston, Texas
1944	
H. B. Fuqua, past-president	Fort Worth, Texas
H. D. Miser	Washington, D. C.
Ira H. Cram	Chicago, Illinois

A preliminary design for the medal has been submitted to the executive committee and has received tentative approval, pending the action of the medal award committee. This preliminary design must later be submitted to a reliable maker of such medals and a



Original, tentative design of Sidney Powers Memorial Medal.

final design executed, which will be suitable for casting the medal. The final medal will follow this same general form but may differ in certain minor details made necessary by the art of medal making.

Solicitation for funds to establish this medal award are now being made and it is hoped that those who desire to contribute to the establishment of this, the first award given by petroleum geologists, will reply promptly to the circular letter which has been sent to each of our members and associates.

BULLETIN OF THE AMERICAN ASSOCIATION OF PETROLEUM GEOLOGISTS
VOL. 27, NO. 6 (JUNE, 1943), PP. 882-886

AT HOME AND ABROAD

CURRENT NEWS AND PERSONAL ITEMS OF THE PROFESSION

ALEX W. McCOY has been promoted from manager to vice-president in charge of land and exploration for the Deep Rock Oil Company, Tulsa, Oklahoma.

DONALD J. MACNEILL has resigned from The Texas Company to accept a position as professor of geology at Saint Xavier University, Nova Scotia.

JACK H. HEATHMAN, formerly with the Gulf Oil Corporation, is now associated with the Hollow Drilling Company, Inc., 400 Brown Building, Wichita, Kansas.

WAYNE C. RAUCH, of the Lion Oil Refining Company, has moved from El Dorado, Arkansas, to Tyler, Texas.

JOSEPH H. TURNER is employed by the Phillips Petroleum Company at Denver, Colorado. His address is Park Lane Hotel, Denver.

LOUIS DESJARDINS has closed his consulting office in Tulsa, Oklahoma, to take charge of the program of aerial geology for the Imperial Oil Company, Ltd., in connection with the Canol Project at Edmonton, Alberta.

L. F. MCCOLLUM, until recently president of The Carter Oil Company, Tulsa, Oklahoma, has assumed new duties with the Standard Oil Company (New Jersey), of which the Carter is an affiliate. OSCAR C. SHORP, formerly vice-president of the Carter, has been advanced to president. McCollum's new headquarters are at 30 Rockefeller Plaza, New York, as assistant to C. H. LIEB, also a former Carter president and now in charge of all producing operations of subsidiary companies of Standard Oil Company (New Jersey).

KENNETH L. GOW, the Superior Oil Company of California, has been transferred from Evansville, Indiana, where he was Illinois Basin district geologist, to 506 First National Building, Denver, Colorado, where he is Rocky Mountain district geologist.

ROBERT R. HARBISON has obtained a leave of absence from Stanolind Oil and Gas Company for enlistment in Officers Candidate School of the Marine Corps. Correspondence may be sent to him at 1828 Harvard, Wichita, Kansas.

F. T. DAMON is on leave of absence from the Phillips Petroleum Company, Bartlesville, Oklahoma, and is an ensign, temporarily stationed at Corpus Christi, Texas, Naval Air Station.

HORACE E. RANKIN, Shell Oil Company, Inc., has been transferred from Centralia, Illinois, to Tulsa, Oklahoma.

GEORGE GALLOWAY of the Stanolind Oil and Gas Company has been transferred from Wichita, Kansas, to Tulsa, Oklahoma.

B. H. RICHARDS, JR., formerly of St. Elmo, Illinois, is newly connected with Ingling and Parker Company and Alco Valve Company, Fourth National Bank Building, Wichita, Kansas.

WILLIAM G. BLACKWELL terminated his services with the State of Louisiana as New Orleans district manager of the Minerals Division on April 1 and is now associated with the Sugar Field Oil Company, Baton Rouge, Louisiana, as geologist and petroleum engineer.

MARTIN G. EGAN, consultant, has moved his office from Mt. Carmel, Illinois, to Midland, Texas. His mailing address is Box 1548.

ROBERT B. MITCHELL, formerly with Stanolind Oil and Gas Company, Houston, may be addressed in care of Foran, Boatright, and Dixon, 1906 Second National Bank Building, Houston, Texas.

ROBERT C. REDFIELD resigned in October, 1942, as assistant geologist with the Bureau of Economic Geology of Texas to become associate mining engineer with the United States Bureau of Mines in the district office for Texas at Austin.

LAURENCE BRUNDALL, Ensign, U.S.N.R., has been attending the Navy's School of Photo Interpretation at Anacostia, D. C., and completed his course on April 7.

GEORGE V. COHEE has been granted leave of absence from the Indiana Geological Survey to become production analyst in the economics and supply section of the Production Division for the Petroleum Administration for War. His address is Interior Building, Washington, D. C.

P. HASTINGS KELLER is acting assistant State geologist with the Indiana Geological Survey, Indianapolis, Indiana.

Ensign CLELAND N. CONWELL, formerly with the petroleum department of the Stearns-Roger Company, Denver, Colorado, has been called to active duty and is stationed at the Naval Training Station, University of Arizona, Tucson, Arizona.

KENNETH W. GERMOND has been commissioned an ensign and assigned to the photographic interpretation branch of the Bureau of Aeronautics. His permanent address is in care of R. G. Atwood, Box 577, Sour Lake, Texas.

PETER H. GARDETT, formerly of the General Petroleum Corporation of California, is an ensign, temporarily stationed at N.T.S. (I), Quonset Point, Rhode Island.

Captain PERRY S. MCCLURE has been teaching at the Armored Force School for a year and has just completed the 9-weeks course at the Command and General Staff School at Fort Leavenworth. His new assignment is with the 5th Armored Signal Battalion, Camp Campbell, Kentucky.

D. R. KNOWLTON, 339 North Willard Avenue, San Gabriel, California, is assistant reservoir engineer with the California Conservation Committee.

H. V. TYGRETT, the Atlantic Refining Company, has been transferred from Lake Charles, Louisiana, to Tulsa, Oklahoma.

EDWARD J. FOLEY, formerly with the Standard Oil Company of New Jersey, is now with the Imperial Oil Company, Norman Wells, Northwest Territories, Canada.

JOHN TEAGLE has moved from Corpus Christi, Texas, to Chipley, Florida, where he is with the Humble Oil and Refining Company.

WILBUR H. SEIFERT of Oil City, Pennsylvania, resigned as gas engineer with the Pennsylvania Public Utility Commission, and since June, 1942, has been employed as progress and special engineer with Gannett, Eastman and Fleming, Inc., of Harrisburg, Pennsylvania, engaged in the construction of the Shenango Personnel Replacement Depot.

F. L. FOURNIER, formerly with International Petroleum Company, Guayaquil, Ecuador, is now with Imperial Oil Limited, Calgary, Alberta, Canada.

GILBERT A. TALLEY has been employed by the Lion Oil Refining Company, 509 Tower Building, Jackson, as district geologist for Mississippi.

LEE C. LAMAR, of the Carter Oil Company, has been transferred from the Michigan office to Mattoon, Illinois.

BASIL B. ZAVOICO, of the Chase National Bank, New York, is assistant director of reserves in the Petroleum Administration for War, Room 7447, Interior Building, Washington, D. C.

EDWARD T. HECK, assistant geologist of the West Virginia State Geological Survey, has been commissioned a lieutenant, junior grade, in the United States Navy.

JOHN B. LUCKE, associate professor of geology and head of that department at the University of Connecticut, has been granted leave to accept a commission as lieutenant (jg) in the United States Naval Reserve.

PAUL M. BUTTERMORE, recently an independent operator and consulting geologist at East Lansing, Michigan, is a petroleum production analyst in the facilities section of the Production Division of the Petroleum Administration for War, Room 7061, South Interior Building, Washington, D. C.

RALPH G. HUBMAN, 115 Key Avenue, Wheeling, West Virginia, has entered the service as an ensign in the United States Naval Reserve.

JORGEN O. NOMLAND, retired assistant chief geologist of the Standard Oil Company of California, died at his home at Lafayette, California, May 7. His age was 58 years.

CECIL G. LALICKER, associate professor of geology at the University of Oklahoma, has been granted a leave of absence to work for the Union Oil Company of California in Houston, Texas.

A. I. LEVORSEN, consulting geologist of Tulsa, addressed the Pacific Section of the Association in Los Angeles, May 21, on the subject, "Trends in Discovery Thinking."

H. L. MOORE, recently with the Atlantic Refining Company as district geologist at Tulsa, is in charge of exploration for J. E. Crosbie, Inc., Tulsa, Oklahoma.

WERNER TAPPOLET, formerly with the Shell Oil Company, may be addressed in care of the geological department of the Gulf Oil Corporation, Tulsa, Oklahoma.

E. W. FOSSHAGE, who has been with the Shell Oil Company in Tulsa for several years, is in the geological department of the Devonian Oil Company, Tulsa, Oklahoma.

O. E. MEINZER, geologist in charge of the Division of Ground Water Resources Branch of the United States Geological Survey, Washington, D. C., was recently awarded the fifth William Bowie medal for advancement of cooperative research in geophysics.

Lieutenant Colonel BYRON RIFE, of the Ordnance Department, has been transferred from the field director's office in St. Louis to take command of both the Kankakee Ordnance Works and the Elwood Ordnance Plant near Joliet, Illinois.

WARD C. BEAN, of the Shell Oil Company, Inc., Wichita Falls, Texas, spoke on "The Geology of The Roumanian Oil Fields," before the North Texas Geological Society, April 26.

A. RODGER DENISON, president of the Association and chief geologist of the Amerada Petroleum Corporation, Tulsa, Oklahoma, spoke before the first spring meeting of the

Petroleum Division of the A.I.M.E., in Dallas, Texas, May 8, on "Exploration and Exploitation."

CHARLES H. RANKIN has resigned his position with the Continental Oil Company, Denver, Colorado. He had been with the company 15 years, serving as geologist and district foreman of production.

WILLIAM MCCORMICK REID, formerly with the Humble Oil and Refining Company at Houston, Texas, and recently engaged in oil-production operations in Canada for the United States Army, died at Edmonton, Alberta, May 11.

LAWRENCE W. CURTIS, whose permanent address is 514 Stewart Road, Columbia, Missouri, is a second lieutenant, meteorologist, in the air corps.

JOHN F. GALLIE has resigned from the Naval Ordnance Laboratory to become a consultant in the Natural Gas and Natural Gasoline Division of the Petroleum Administration for War, Washington, D. C. Gallie is business manager of the Society of Exploration Geophysicists.

W. M. PLASTER, geologist for G. H. Vaughn, the Dixie Drilling Company, and G. H. Vaughn, Jr., of Dallas, Texas, is moving his headquarters from Shreveport, Louisiana, to Magnolia, Arkansas.

GILBERT W. NOBLE, of the department of mining engineering at the University of Missouri School of Mines and Metallurgy, Rolla, has been engaged as petroleum engineer by the Ohio Oil Company, Findlay, Ohio. His work will include statistics and economics.

CHARLES F. BASSETT, formerly chairman of the department of geology and geography at the University of Kansas City, is in the employ of the Gulf Oil Corporation at Pittsburgh, Pennsylvania.

JACK W. DAVIES, of the Halliburton Oil Well Cementing Company, Wichita Falls, Texas, is a lieutenant with the Army Engineers on the Alcan Highway.

STEPHEN G. WAGGONER, consulting geologist, Wichita Falls, Texas, is a second lieutenant, assistant director of personnel, Civilian Personnel Office, Fort Huachuca, Arizona.

GLENN S. DILLE, consulting geologist, Atlas Building, Tulsa, gave his presidential address before the Tulsa Geological Society, May 17. It was entitled, "Pre-Pennsylvanian Stratigraphy of Western Nebraska."

DALE DAVID KERSTETTER, recently with the Standard Oil Company of Venezuela in Caracas, is employed in the Naval Ordnance Laboratory, Washington, D. C.

C. L. SEVERY is with the United States Bureau of Mines at Salt Lake City, Utah.

E. B. BALDWIN, consulting geologist of Houston, Texas, is a lieutenant in the navy. He may be addressed at 3609 Porter Avenue, El Paso, Texas.

New officers of the Tulsa Geological Society are: president, ROBERT E. GARRETT, consulting geologist; 1st vice-president, J. V. HOWELL, consulting geologist; 2nd vice-president, JERRY E. UPP, Amerada Petroleum Corporation; secretary-treasurer, JAMES A. PRICE, W. C. McBride, Inc., 625 Wright Building; editor, ROY L. GINTER, Ginter Laboratory.

F. JULIUS FOHS talked on "Some Notes on the Middle East," before the Houston Geological Society, May 20.

FRANK T. CLARK, district geologist for the Cities Service Oil Company of Odessa, Texas, has retired after 18 years of service with the company.

ROBERT B. CAMPBELL, of Tampa, Florida, is temporarily at the Sheppard and Enoch Pratt Hospital, Towson, Maryland, convalescing after strenuous exploratory activity in Florida. He will be glad to receive greetings from his friends.

Major EDGAR W. OWEN, a past-president of the Association, may be addressed as follows: A.P.O. 925, c/o Postmaster, San Francisco, California. This probably means that the major is somewhere in the Pacific region of activity.

The annual dinner meeting and ladies' night of the Branner Geological Society was held on May 26, at the Athenaeum, California Institute of Technology, Pasadena. The speaker of the evening was BENO GUTENBERG, professor of geophysics at the California Institute of Technology, who delivered an address on "The Structure of the Earth." Newly elected officers are: president, HERSCHEL L. DRIVER, Standard Oil Company of California; vice-president, ROBERT W. WEBB, department of geology, University of California at Los Angeles; secretary-treasurer, VINCENT W. VANDIVER, Seaboard Oil Company. Retiring officers are: president, WAYNE GALLIHER, Barnsdall Oil Company; vice-president, W. C. PUTNAM, department of geology, University of California at Los Angeles; and secretary-treasurer, CLEMENT D. MESERVE, of the department of geology, Glendale Junior College.

The North Texas Geological Society, Wichita Falls, has elected the following officers: president, DAN D. HENINGER, The Ohio Oil Company; vice-president, DOLPHE E. SIMIC, Cities Service Oil Company; secretary-treasurer, CARLOS M. FERGUSON, Magnolia Petroleum Company.

M. G. CHENEY, president of Anzac Oil Corporation, spoke before the North Texas Geological Society, May 28, on "The Stratigraphic Classification of the Pennsylvanian Strata of North Central Texas."

LELAND W. JONES, of Tulsa, Oklahoma, is in the employ of the Anderson-Prichar Oil Corporation, Oklahoma City.

HENRY J. HAWLEY has been appointed chief geologist of the foreign department of the Standard Oil Company of California at San Francisco.

A. E. FATH may be addressed at 905 Lancaster Building, Calgary, Alberta, Canada.

THOMAS W. LEACH is at 700 Patterson, Bismarck, North Dakota.

H. BAGGELAAR, recently with the United British Oilfields of Trinidad, at Point Fortin, is with the Caribbean Petroleum Company, Apartado 19, Maracaibo, Venezuela.

NORVAL W. NICHOLS has returned from New Zealand and is with the Superior Oil Company, First National Bank Building, Denver, Colorado.

C. W. TOMLINSON, consulting geologist and operator of Ardmore, Oklahoma, spoke before the Rotary Club at Olney, Illinois, on "Profits in Business," and before the Illinois Geological Society, May 31, on "Natural Resources in Post-War Planning."

CLARK THOMAS SNIDER, of the Lario Oil and Gas Company, Mt. Vernon, Illinois, has been elected vice-president of the Illinois Geological Society, succeeding J. R. MCGEHEE, of the Shell Oil Company, Inc., who has been transferred to Tulsa, Oklahoma.

MARCUS A. HANNA, of the Gulf Oil Corporation, talked on "Some Theories on the Geology of Salt Domes." at the last spring meeting of the Houston Geological Society, June 3.

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209 Ellis-Singleton Building
Manager of Well Log Bureau - Harvel E. White

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Cities Service Oil Co., Mt. Pleasant

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The Atlantic Refining Company, Box 2407

Meetings: First and third Wednesdays of each month from October to May, inclusive, at 7:30 P.M., Edwards Hotel, Jackson, Mississippi. Visiting geologists welcome to all meetings.

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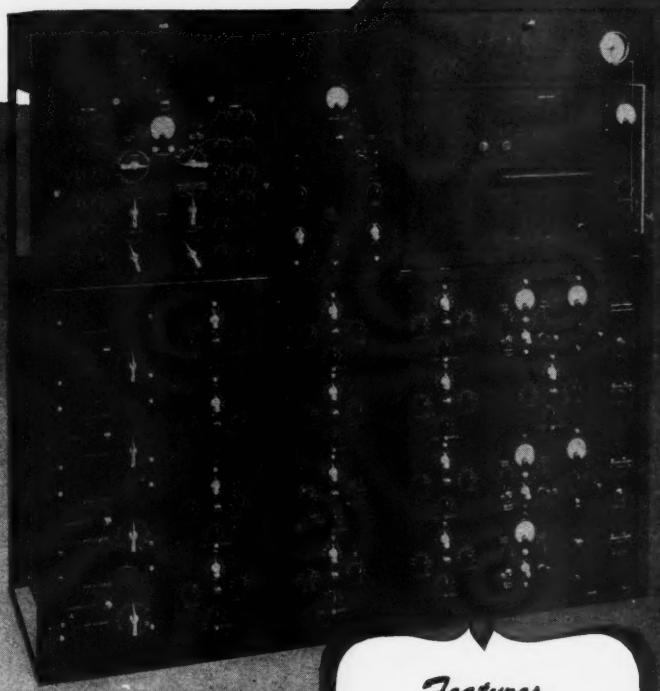
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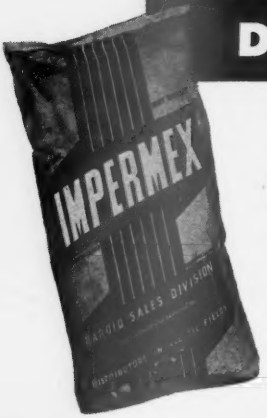
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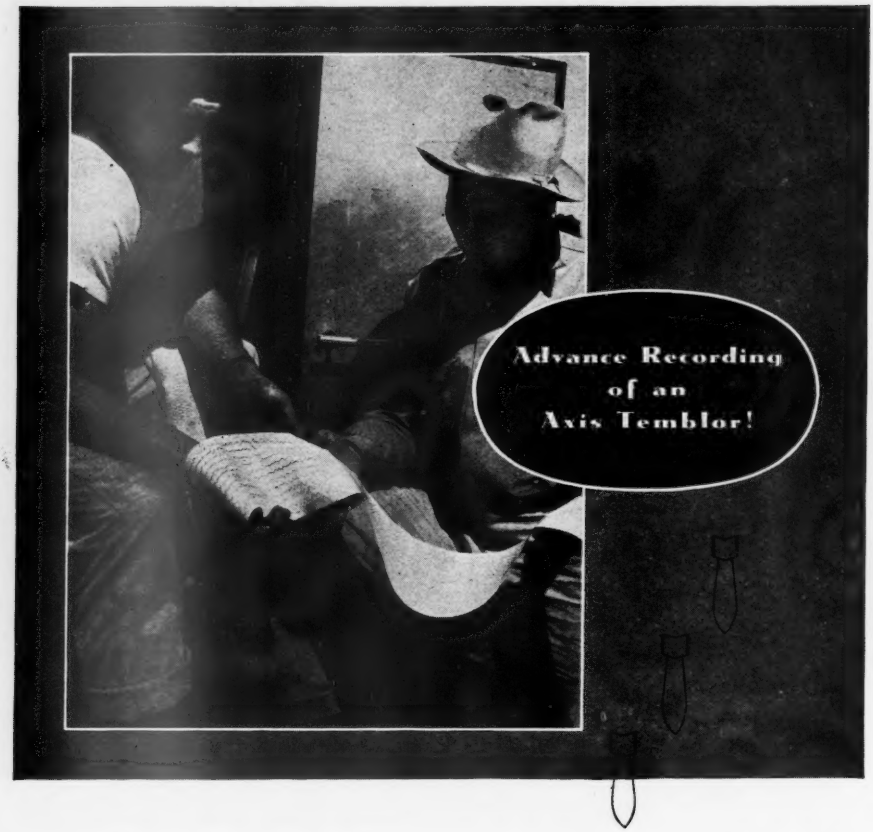


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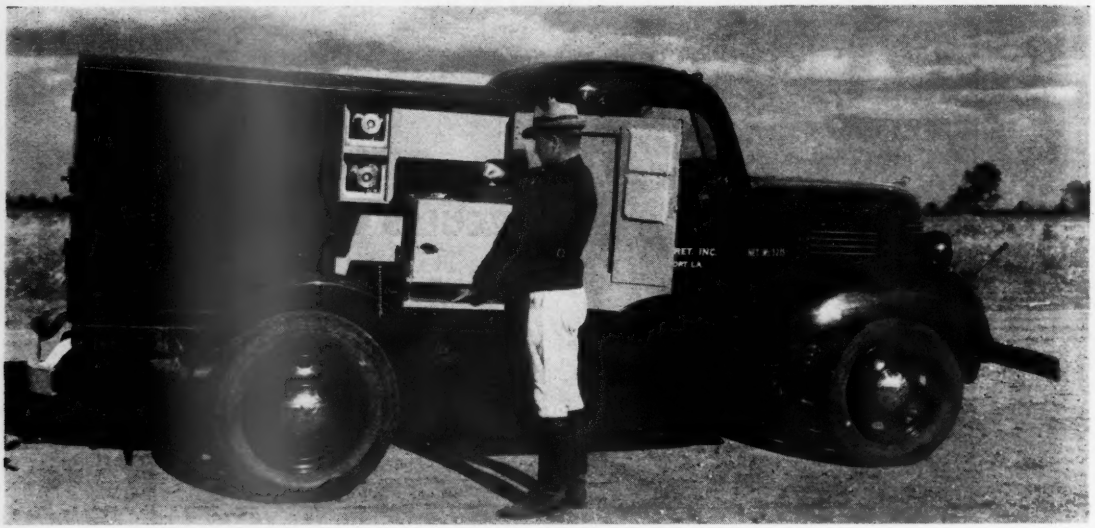
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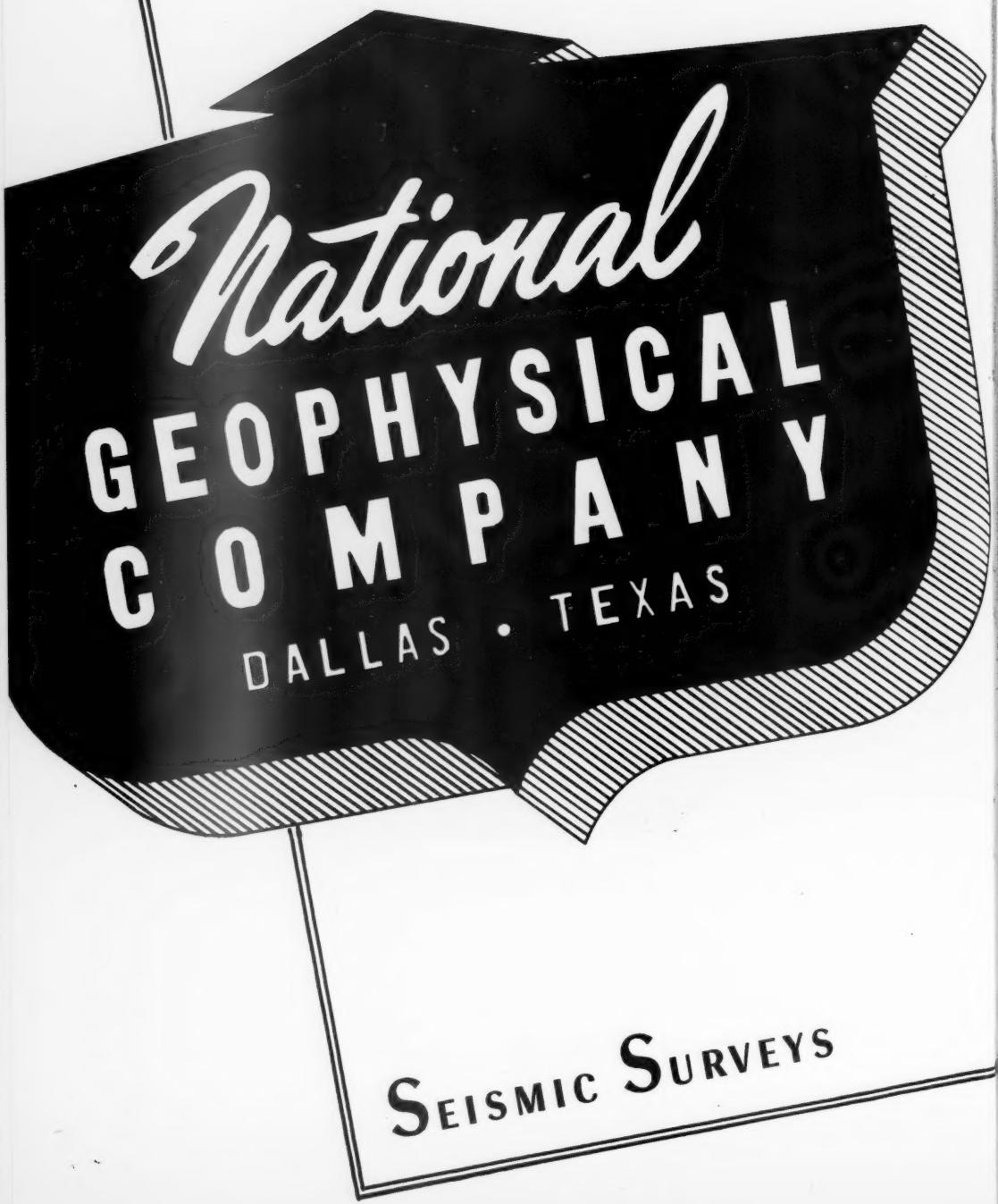
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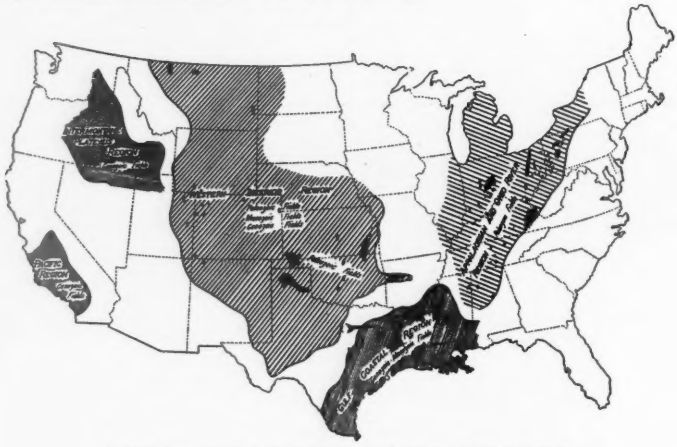
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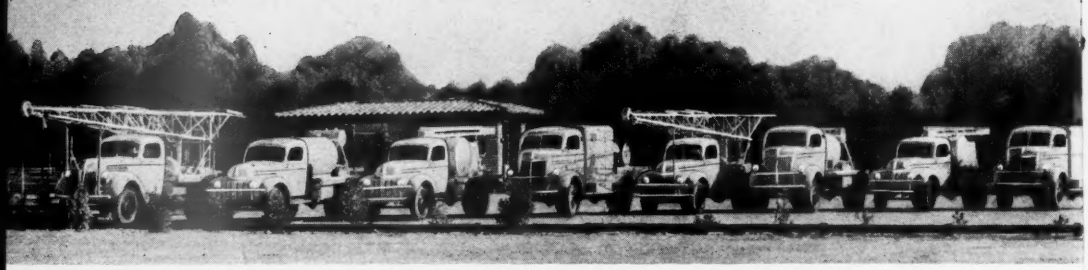
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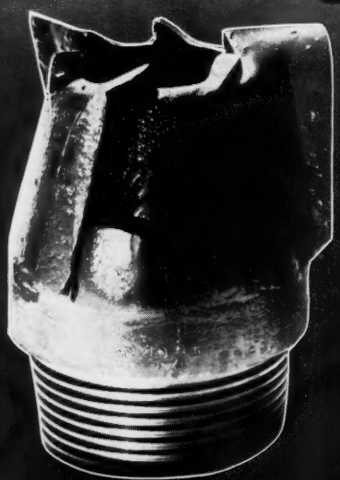
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